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"Made in China 2025": China's development strategy through technological innovation

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Orientadora: Profª. Catedrática Doutora Carla Margarida Barroso Guapo da Costa

Dissertação para obtenção de grau de Mestre
em Relações Internacionais

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Lisboa
2019

ACKNOWLEDGMENT

First of all, I would like to express my sincere gratitude to my advisor, Professor Carla Guapo da Costa, for her motivation, immense knowledge and wise suggestions that always direct me in the right academic course; and for her critical attitude in the course of *International Political Economy* that enlightens me with the ideas of the present thesis.

Besides my advisor, I would like to thank Professor Andrea Valente and Professor Nuno Canas Mendes for their insightful comments for my project in the workshop.

My sincere thanks also go to Professor Sandra Balão and Professor Álvaro Nóbrega for their academic passion and preciseness that deeply inspire me.

I thank my classmates for the thought-provoking discussions in class and the sharing of life experiences; also, I thank Ms. Inês Calixto and the library workers for their kindness and help.

I want to express my special gratitude to my friends Ricardo Carvalho and Carlos Cabral for their timely help when I was facing difficulties in the thesis; to my friend Liujuan Li, for the days we were studying and having fun together in the arduous academic life.

Then, my wholehearted appreciation extends to my family for their deep love, and to my boyfriend for his firm support.

Lastly, I want to give unique gratitude to myself for braveness and determination.

ABSTRACT

The present thesis concentrates on China's industrial plan, *"Made in China 2025"* (MIC2025). The plan has a dual instrumental function, namely, upgrading China's industrial system and contributing to achieving China's dream of great rejuvenation. China has developed from a low-income economy into a middle-income one owing to its pragmatic reforms since the end of the 1970s. However, due to the environmental problems and social disparity caused by the traditional development model, China has the risk of failing during its transformation into a high-income country and dropping in the middle-income trap (MIT). On the other hand, along with economic growth, China has shifted its low-key foreign policy to a proactive one and launched proposals for Asian security and world order. In this sense, China may encounter competition with the existing hegemony, the U.S., and drop into the Thucydides Trap (TT).

With the hypotheses of falling into two traps, this research has used the mixed methods of quantitative and qualitative approaches.

In the quantitative approach, we have established two links by connecting the dual function of MIC2025 with two traps by using independent, dependent, mediating, and moderating variables for the hypotheses. In the first link, we have found that, although China has established a specific technological base, China still stands far away from the technological frontier. Thus, it is not easy for China to escape the MIT. In the second link, we have found that China's position in the world order does not threaten America's dominant position. However, China's proposals for Asian security and the world may bring itself into a competition with the U.S. and fall into the TT.

In the qualitative approach, we have done two semi-structured interviews, according to which China can escape the traps. However, the possibility of falling into two traps cannot be overlooked.

Keywords: China; *"Made in China 2025"*; technological innovation; development strategy; middle-income trap; Thucydides Trap.

RESUMO

A presente tese concentra-se num plano industrial da China, "*Made in China 2025*" (MIC2025). O plano tem uma função instrumental dupla, ou seja, atualizar o sistema industrial por inovação tecnológica e contribuir para alcançar o sonho da China de um grande rejuvenescimento. Assim, a dissertação é analisar se a China pode reformar a ordem mundial por inovação tecnológica.

Atualmente, a China entrou num período crítico de transição da economia de renda média para a de renda alta. Considerando que a China está a enfrentar problemas ambientais cada vez mais graves e problemas sociais a nível da disparidade, a China corre o risco de não se conseguir transformar, sendo apanhada na *middle-income trap* (MIT).

Por outro lado, como no rápido crescimento económico, a China gradualmente mudou o seu perfil "*low-key*" iniciado no período Deng Xiaoping para uma postura mais proativa na política global, uma diplomacia de país principal, que é entendida como diplomacia dos grandes poderes. A diplomacia serve para ajudar a China a realizar o sonho de modernização e construir uma comunidade com um futuro compartilhado para a humanidade. Sob uma política externa proativa, a ascensão da China provavelmente cairá na *Thucydides Trap* (TT), ou seja, encontrará concorrência com a hegemonia existente, os EUA, o que irá trazer o mundo à instabilidade.

Combinando as funções do MIC2025 e os riscos da China cair em duas armadilhas, propusemos duas hipóteses: o MIC2025 pode ajudar a China a escapar da MIT e manter um desenvolvimento sustentável; e a China, com a força aumentada pelo plano industrial, escapará da TT e contribuirá para melhorar a ordem mundial multilateral.

Considerando vários fatores que afetarão a eficácia das funções do MIC2025, elaborámos adicionalmente três proposições para as respectivas hipóteses.

Especificamente, para a primeira hipótese, as proposições são: o MIC2025 tem a função instrumental de promover o desenvolvimento por inovação tecnológica; A China possui condições pré-existentes para executar o MIC2025; O domínio das economias avançadas em inovação deixará espaço limitado para a China executar o plano.

Para a segunda hipótese, as proposições são: o MIC2025 tem a função instrumental de aumentar a força da China; As propostas da China para o mundo não levarão a China à TT, mas

contribuirão para melhorar a ordem mundial multilateral; A China tem condições limitadas para reformar a ordem mundial, que é estabelecida e mantida pelos EUA e seus aliados.

Com várias hipóteses e proposições, projetámos a pesquisa de uma perspectiva pragmática, o que nos pode permitir fazer escolhas livremente e tirar proveito de diferentes abordagens para alcançar o objetivo.

Sob esta perspectiva, usámos métodos mistos sequenciais explicativos, que envolvem uma recolha de dados quantitativos primeiro e depois explicam os resultados quantitativos com os dados qualitativos.

Na parte quantitativa, primeiramente construímos relações entre as teorias de inovação tecnológica, desenvolvimento e poder, que mais tarde serão usadas como orientação para recolher e analisar os dados quantitativos.

Em seguida, recolhemos os dados quantitativos com a organização das hipóteses e as suas proposições usando variáveis. As variáveis foram escolhidas com base no motivo pragmático, o que nos pode fornecer uma estrutura precisa para direcionar o processo de recolha de dados.

Selecionámos quatro tipos de variáveis para construir a estrutura, ou seja, variáveis independentes, dependentes, mediadoras e moderadoras.

As variáveis independentes são variáveis preditoras que podem causar os resultados, que são variáveis dependentes. As duas variáveis constituem uma estrutura de causa e efeito. Na estrutura, as mediadoras afetarão as dependentes em conjunto com as independentes; enquanto que as moderadoras, com a natureza de variáveis independentes, afetarão a direção e a força da relação entre as independentes e dependentes.

Com base nas características das variáveis e nas hipóteses, elaborámos duas ligações causais.

Especificamente, na Ligação 1, a primeira proposição da função instrumental do MIC2025 em desenvolvimento serve como a variável independente (VI), que causará ou influenciará o resultado de escapar da MIT, que é considerada a variável dependente (VD). Além disso, a segunda proposição das condições preexistentes da China para executar o MIC2025 é a variável mediadora (VM1), afetando positivamente a ligação de causalidade; a terceira proposição de domínio da inovação das economias avançadas é a variável moderadora (VM2), influenciando negativamente a direção da ligação.

Na Ligação 2, a primeira proposição da função instrumental do plano no poder como VI gerará o efeito de VD de ajudar a China a escapar da TT. Além disso, a segunda proposição das propostas da China para o mundo, servindo como VM1, exercerá um efeito positivo sobre a ligação. Por outro lado, a terceira proposição da ordem mundial liberal como VM2 terá um impacto adverso.

Com relação às abordagens de pesquisa, para a Ligação 1, foram utilizadas principalmente as abordagens de análise de conteúdo de materiais em primeira mão e análise secundária de estatísticas oficiais. Na abordagem da análise de conteúdo, os documentos e textos foram recolhidos de livros editados pelo governo chinês, o site do governo chinês e os sites da imprensa principal chinesa (People's Daily, Xinhua, China Daily), enquanto na abordagem da análise secundária das estatísticas oficiais, as estatísticas foram recolhidas no site dos departamentos do governo chinês e da imprensa principal chinesa.

Para a Ligação 2, apesar das duas abordagens usadas na primeira, também usámos os estudos comparativos entre a atual China e o Japão na década de 1980 para analisar a posição da China na ordem mundial.

Após a recolha dos dados, examinamos as relações teóricas que estabelecemos e obtivemos resultados quantitativos.

Na primeira ligação, descobrimos que o MIC2025 oferece uma trajetória orientada à inovação para o futuro desenvolvimento da China. A China construiu uma base tecnológica específica por meio de políticas contínuas de ciência e tecnologia, inovação indígena, investmento interno e investimento externo, que podem ajudar a China a executar o MIC2025. No entanto, a China ainda se mantém distante da fronteira tecnológica, dominada pelas economias ocidentais. Além disso, a proteção de propriedade intelectual (PI) da China ainda é fraca; As empresas privadas da China, que são mais eficientes em comparação com as estatais, foram reprimidas. Por fim, o risco de queda na MIT aumentou, não apenas devido aos problemas existentes em proteção ambiental e disparidade social, mas também ao surgimento do desemprego tecnológico e à intensificação da lacuna de desenvolvimento causada pelo MIC2025. Nesse sentido, é difícil para a China escapar da MIT e manter o desenvolvimento sustentável.

Na segunda ligação, descobrimos que o MIC2025 serve como um passo estratégico para realizar o sonho da China de grande rejuvenescimento. Com o crescente poder económico, militar e

científico, a China propôs as suas soluções para a Ásia e o desenvolvimento mundial. Para a Ásia, trata-se do novo conceito de segurança asiática da China, que enfatiza a participação de todos os países asiáticos na manutenção da segurança. No entanto, isso dificilmente pode ser alcançado, pois nesta região, os EUA mantiveram preeminência militar e desenvolveram aliados estratégicos com vários países asiáticos. Para o mundo, a noção da China de uma comunidade de um futuro compartilhado para a humanidade é representada economicamente pela *Belt and Road Initiative* (BRI). Embora as rotas da BRI se espalhem amplamente, a China considera principalmente os países e regiões vizinhos com os quais pretende cooperar. Assim, a BRI demonstra as características do regionalismo e do bilateralismo. Em relação à posição da China na ordem mundial, comparamos o Japão e a China com os aspectos da sua posição na ordem e a sua relação com os EUA. Descobrimos que, na ordem mundial, a posição da China não representa ameaças à posição de liderança da América. Além disso, os dois países desenvolveram relações económicas interconectadas. Os dois elementos podem ajudar a China a escapar dos conflitos com os EUA. No entanto, a China tende a mudar seu *status quo* e torna-se desafiadora da ordem. Nesse sentido, a China e os EUA podem cair na TT sobre questões de segurança na Ásia.

Com os resultados quantitativos, escolhemos dois entrevistados (um funcionário da Embaixada da China em Portugal e uma repórter da China Daily) familiarizados com as questões tecnológicas da China e interessados na ascensão da China usando entrevistas semiestruturadas.

Para os dados qualitativos, usámos análise crítica do discurso. Descobrimos que os entrevistados mantêm uma atitude realista de que a China atualizará o sistema industrial e obterá mais poder económico; enquanto para o futuro da ascensão da China, os entrevistados têm uma perspectiva liberal de que a China pode realizar uma ascensão pacífica devido à interdependência económica no mundo. Em suma, os dois pensam que a China pode escapar da MIT e da TT.

Por fim, concluímos que o MIC2025 é crucial para a China alcançar os países desenvolvidos. A China não pode utilizar o plano para alcançar o desenvolvimento sustentável sem considerar a proteção ambiental, a justiça social, a proteção de PI e a motivação dos empreendedores. Por outro lado, no processo de alcançar o mesmo, a China pode escapar intencionalmente da TT e concentrar-se no desenvolvimento económico. No entanto, na Ásia, tendo em com consideração a segurança nacional, a China não pode evitar conflitos com os EUA para defender seus interesses nacionais.

Palavras-chave: China; *"Made in China 2025"*; inovação tecnológica; estratégia de desenvolvimento; *middle-income trap*; *Thucydides Trap*.

ABBREVIATIONS

3GPP	the 3rd Generation Partnership Project
ADB	Asian Development Bank
AI	artificial intelligence
BAT	*Baidu, Alibaba,* and *Tencent*
BRI	Belt and Road Initiative
BRICS	Brazil, Russia, India China, and South Africa
CAE	Chinese Academy of Engineering
CPO	Patent Office of China
CSC	China State Council
FER	foreign exchange reserve
FDI	foreign direct investment
FSA	firm-specific asset
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
GVC	global value chain
HSR	high-speed railway
IoT	Internet of Things

IP	intellectual property
IR	international relations
ISDP	Institute for Security & Development Policy
LIC	low-income country
LDCs	less developed countries
MIC2025	*Made in China 2025*
MIT	middle-income trap
MNCs	multinational companies
MOFCOM	(China's) Ministry of Commerce
NBSC	National Bureau of Statistics of China
NCCPC	National Congress of the Communist Party of China
NEA	new energy automobile
NMSAC	(China's) National Manufacturing Strategy Advisory Committee
OECD	Organization for Economic Cooperation and Development
OFDI	outward foreign direct investment
R&D	research and development
SEZs	Special Economic Zones
SOEs	state-owned enterprises

S&T	science and technology
TRIPs	Trade-related Aspects of Intellectual Property Rights
TT	Thucydides Trap
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WTO	World Trade Organization
WWII	the Second World War

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INTRODUCTION

China, known as the biggest developing country, has developed from a low-income economy into a middle-income one, due to its pragmatic reforms since the end of the 1970s (Cai, 2012). At present, China has entered a critical period of turning from a middle-income economy into a high-income one (Aoki, 2011; Cai, 2012). However, China has been facing increasingly severe environmental problems and social problems regarding disparity in income distribution. Thus, China is at risk of failing and being trapped in the middle-income trap (MIT) (Cai, 2012; Gill et al., 2007).

On the other hand, along with rapid economic growth, China has gradually changed its "low-key" profile, which started in the Deng Xiaoping period (Yan & Gong, 2018), into a more proactive posture in global politics (Zhang, 2010). Under the leadership of Xi Jinping in 2012, China put forward a "major country" diplomacy (*Daguo waijiao*) (People.cn, 2017) that is defined as "Great power diplomacy" by various scholars worldwide (Dotson, 2019; Miller, 2013; Takahashi, 2017; Zhang, Ye, Wang, Galli & Budeanu, 2018). This diplomacy is meant to help China fulfill *China Dream* of modernization and build up a community with a shared future for humankind (*Ibid.*). Under the proactive foreign policy, China's further rise will probably make it fall into the Thucydides Trap (TT), namely facing competition with the existing hegemony, the U.S., in a process of growing instability in world economics and politics (Allison, 2015; Lee, 2019).

Under this background, in 2015, the Chinese government launched an industrial plan called *"Made in China 2025*" (MIC2025) (China State Council - CSC, 2015). The plan aims at upgrading China's industrial system and building up industries in ten vital sectors, with a strategic aim of becoming less dependent on some key sectors and further fulfilling *China Dream* of modernization (*Ibid.*). Thus, this research is developed under the topic of *"'Made in China 2025': China's development strategy through technological innovation."*

RESEARCH RELEVANCE, RESEARCH QUESTION, AND OBJECTIVES

The research evolves under the discipline of the political economy of international relations (IR). Specifically, in IR, the state is the main actor. From a realist perspective (Carr, 1946/1981; Knorr, 1975; Morgenthau, 1985; Waltz, 1959), the political order is characterized by anarchy.

In the anarchy, without an organized power, there exists no automatic harmony (Waltz, 1959). Thereby, the states are likely to face a security dilemma, which forces them to obtain more power to achieve their goals, of which the most important one is security (Carr, 1946/1981; Morgenthau, 1985; Waltz, 1959).

Under the discipline of political economy, the states usually take measures of "reducing the home state's dependence on others" (Gill & Law, 1988, p. 27) to increase the security. In other words, complete self-sufficiency is ideal for a state's economic security (Gill & Law, 1988). In practical terms, the state will make industrial policies to build up its strategic industries, which concern "national security and self-sufficiency in vital sectors" (*Ibid.*, p. 28).

MIC2025 is China's strategic industrial policy. Since 2015, it has triggered quite different reactions inside and outside of China.

Chinese scholars generally hold a positive attitude towards the plan and consider it imperative for China's sustainable development. It is destined to contribute directly to the implementation of the manufacturing transformation and upgrade (Xiang, 2015) to further equip China with core technologies (Zhang, 2016) in the areas of digitalization, networking, and intelligence. Finally, it will hasten the fulfillment of China's dream "of moving into the high-income club" (Wei, Xie & Zhang, 2017, p. 68) through technological innovation (Liu, Liu & Zhang, 2018). Thus, for them, MIC2025 acts as the new engine of China's development, while coupled with challenges in the areas of manufacturing capabilities, research and development, and human capital (Li, 2017).

In contrast, non-Chinese scholars have quite different attitudes: a few scholars (Jung, 2016) maintain a reserved attitude toward the plan, while the rest is dominated by vigilance (Heilmann, 2016). These phenomena are mainly caused by the hypothesis that China's transformation into a manufacturing superpower will result in steep challenges for the existing manufacturing powers (Institute for Security & Development Policy - ISDP, 2018) due to "perceived intellectual property (IP) abuses, and discrimination against foreign companies" (ISDP, 2018, p. 1). Particularly the United States, as the leading technological power, will encounter threats from the rise of China (Deutch, 2018) and "an unwelcome but unavoidable contest" (Lewis, 2018, p. 7) with China for the leading role in the international order (Lewis, 2018). This unavoidable contest is called TT, a term that Graham Allision (2015) coined to indicate the instability in U.S.-China relations led by the structural change that China's rising caused.

Besides these two kinds of views, Malkin (2018) has an entirely different perspective. Malkin states that China's approach to innovation can be regarded as "a global trade governance issue" to test the "balance between binding rules and policy space since the establishment of the WTO (World Trade Organization)" through integrating China into a "rules-based global trading order" (p. 21).

After reviewing the literature, one can find that both of these perspectives have concentrated on just one of the possible effects - national or international - of the plan, and lack comprehensive consideration.

Besides, we have also found that the existing theories of technological innovation and development have been born in a capitalist background and have not provided the experiences of a non-capitalist developing country. Therefore, we will conduct original work and focus on the case of China. We will accurately testify if the mechanism of technological innovation can still be useful for China in the aspect of promoting its development and accelerating its rise in international politics.

Therefore, our research will contribute comprehensive and original perspectives to the analysis of the plan dealing with prospective Chinese development and China's rise in the world order.

The research will start with the question:

- Is MIC2025 an instrument for China's development strategy to enhance its position in the world order?

To answer the research question, we propose the general objective:

- To analyze if China can reform the actual world order through technological innovation

And five specific ones:

- To explore the strategic importance of MIC2025
- To examine China's pre-existing conditions for performing MIC2025
- To inspect China's limitations for performing MIC2025
- To analyze China's position in the current world order
- To evaluate China's proposals for the world order

HYPOTHESES, RESEARCH DESIGN, AND DATA COLLECTION

Concerning the research question, there are two directions to elaborate on our hypotheses. The first one is the instrumental function of MIC2025 in promoting China's development, and the other is in helping China rise in the world order.

Combining the first direction and China's risk of falling into the MIT, the first hypothesis is proposed as follows:

H1: MIC2025 can help China escape the MIT and maintain sustainable development.

It needs to be noted that various factors and constraints will affect the effectiveness of the plan in exerting its instrumental function of development. Naturally, regarding this hypothesis, we have further elaborated three propositions:

P1: MIC2025 has the instrumental function of promoting development by technological innovation.

P2: China has pre-existing conditions to perform MIC2025.

P3: Advanced economies' dominance in innovation will leave limited space for China to carry out the plan.

Combining the second direction and China's risk of falling into the TT, the second hypothesis is brought forth:

H2: China, with the strength enhanced by the industrial plan, will escape the TT and contribute to the reinforcement of a multilateral world order.

With similar logic, there are factors and constraints that will affect the plan's effectiveness in exerting its instrumental function of power. Thus, for the second hypothesis, we have also elaborated three propositions:

P1: MIC2025 has the instrumental function of increasing China's strength.

P2: China's proposals for the world will not lead China to the TT, but instead will lead the country to enhance multilateral world order.

P3: China has limited conditions to reform the world order, which is established and maintained by the U.S. and its allies.

To start our research design, we should first choose an appropriate philosophical view that is composed of "a set of beliefs that guide action" (Guba, 1990, *cit.*, Creswell, 2014, p. 6) and can direct us to the research purpose.

Having considered the hypotheses and related propositions, we chose the pragmatism, a world view that "is not committed to any one system of philosophy and reality" (Creswell, 2014, p. 11) and will permit us to freely make choices (Creswell, 2014) and take advantages of different approaches to realize the aim.

From a pragmatic perspective, the investigation will be concentrated on the problem and the results in the mixed context concerning political, economic, social, and other factors (*Ibid.*).

Naturally, under the background of complex international relations, to achieve our research purpose, we decided to design our research by using the mixed methods constituted of the combination of quantitative and qualitative approach, which provide us with "a more complete understanding of a research problem than either approach alone" (*Ibid.*, p. 4), and give us access to both quantitative and qualitative data (Creswell, 2014).

In our research, therefore, the explanatory sequential mixed methods design has been used, in which it involves the collection of quantitative data first and then explains the quantitative results "in more detail" (Creswell, 2014, p. 224) with the qualitative data.

First of all, we have constructed relations among the theories of technological innovation, development, and power, which will later be used as the direction for us to collect and analyze the quantitative data.

Then, we start collecting the quantitative data with the organization of the hypotheses and their propositions by using variables, the common elements in quantitative approach, which refers to "a characteristic or attribute of an individual or an organization that can be measured or observed and that varies among the people or organization being studied" (Creswell, 2014, p. 52).

The variables have been chosen in our study based on the pragmatic motive, considering its attribute of dividing elements of "a given situation" (*Ibid.*) into "at least two mutually exclusive

categories" (*Ibid*.), providing us with the precise structure to direct the process of data collections.

In constructing the structure, we principally selected four types of variables: independent variables, dependent variables, mediating variables, and moderating variables.

The independent variables, also named "treatment, manipulated, antecedent or predictor variables" (*Ibid*.) can "cause, influence, or affect" (*Ibid*.) the outcomes, which are defined as dependent variables (Creswell, 2014).

With independent variables and dependent variables, a cause-and-effect structure is set up (*Ibid*.), in which there exist other variables that exert impacts on the causal link (*Ibid*.), like mediating variables and moderating variables.

The mediating variables, according to Creswell (2014), are in the middle of the causal link and "mediate the effects of the independent variable on the dependent variable" (p. 52). The moderating variables are different, as they belong to "independent variables that affect the direction and the strength of the relationship between independent and dependent variables" (Thompson, 2006, *cit.*, Creswell, 2014, p. 53). In other words, the dependent variables will depend on the "joint impact" (Creswell, 2014, p. 53) determined by both the independent and mediating variables (Creswell, 2014).

Based on the characteristics of the variables and the hypotheses, thus, we have elaborated two causal links.

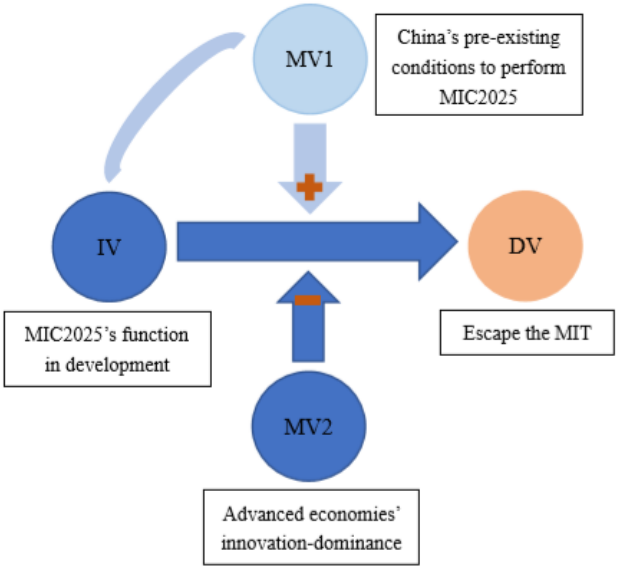

Figure 1 Link 1

Source: Made by the author

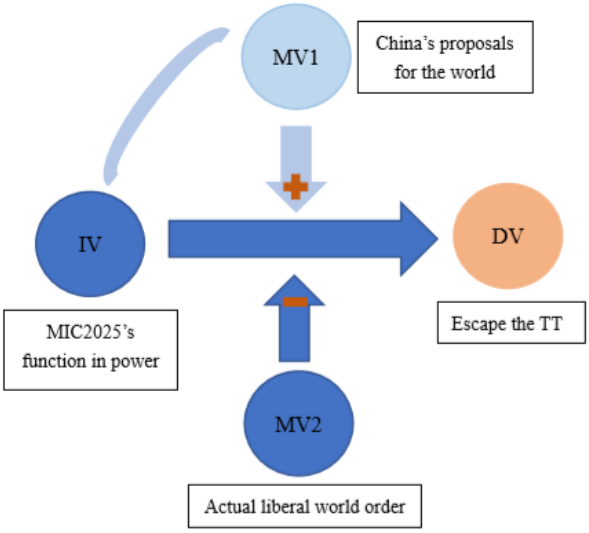

Figure 2 Link 2

Source: Made by the author

Specifically, in Link 1 (see Figure 1), the first proposition of instrumental function of MIC2025 in development serves as the independent variable (IV) that will cause or influence the outcome of escaping the MIT, which is regarded as the dependent variable (DV). Moreover, the second proposition of China's pre-existing conditions to perform MIC2025 is the mediating variable (MV1) positively affecting the causal link; the third proposition of innovation dominance of

advanced economies is the moderating variable (MV2) negatively influencing the direction of the causal link.

In Link 2 (see Figure 2), the first proposition of the instrumental function of the plan in power as IV will generate the effect of DV of helping China escape the TT. Also, the second proposition of China's proposals for the world, serving as MV1, will exert a positive effect over the causal link. Conversely, the third proposition of the actual liberal world order, as MV2, will have adverse effects on the link.

With relation to the research approaches, for the first causal link, we mainly used the approaches of content analysis of first-hand materials and secondary analysis of official statistics (Bryman, 2012). In the approach of content analysis, the documents and texts were collected from books edited by the Chinese government, the websites of the Chinese government, and the websites of the principal Chinese media (China Daily, People's Daily, Xinhua). In the approach of secondary analysis of official statistics, the statistics were collected from the websites of Chinese government departments and the principal Chinese media.

For the second causal link, despite the two approaches used in the first link, we also used one of the comparative studies between the current China and Japan in the 1980s to analyze China's position in the world order.

After collecting the data, we examined the theoretical relations that we have established and obtained a quantitative result, which can inform "the types of participants to be purposefully selected" (Creswell, 2014, p. 224) for our following qualitative study.

The qualitative study was conducted with the instrument of semi-structured interviews; the questions served as "an interview guide" (Bryman, 2012, p. 471), leaving for the interviewee "a great of leeway in how to reply" (*Ibid.*).

The interview was designed with a list of interviewees, including a Chinese official (from China's Embassy in Portugal), a Chinese reporter (from China Daily), Chinese company representatives (from *Huawei* and *ZTE*), and foreign representatives (from American and Japanese Embassy in Portugal).

After having contacted the planned interviewees, both the Chinese company representatives and foreign representatives did not accept the invitation.

Thereby, our interviewees are made up of one Chinese official and one Chinese reporter. Both the interviewees are familiar with Chinese technological issues and interested in China's rise in global politics. The interview with the Chinese official was a face-to-face one, while the one with the reporter was finished by telephone due to the distance.

In the final phase, we have used critical discourse analysis, which is an inductive approach (Bryman, 2012) to analyze the qualitative data collected from the interviews responding to the quantitative results.

PART ONE THEORETICAL BACKGROUND

INTRODUCTION

Within the research question, we are generally considering two main perspectives: one discusses how technological innovation promotes development, and the other discusses how technological innovation affects the formation of political power and further the world order.

Thus, the core theories in our research are technological innovation, development, and power. Naturally, the structure will be built up in the aspect of exploring relations among these theories.

However, there is no direct literature that analyzes the relations. Through a thorough consultation and organization of relevant literature, we have constructed connections among them.

First of all, technological innovation is a complex economic phenomenon because of its nature of creative destruction and knowledge, various determinants and dynamics, and different actors of entrepreneurs and state, and by combining the nature of development, technological innovation can serve as an effective instrument in promoting development nationally or internationally; furthermore, it can also be transformed into the various forms of political power and then used by the countries to enhance their positions, which deeply affects the formation of world order.

Therefore, our theoretical background will be built up in three sections of technological innovation, technological innovation and development, and technological innovation and power.

1. TECHNOLOGICAL INNOVATION

1.1.NATURE OF TECHNOLOGICAL INNOVATION

In the literature, there is no specific definition of technological innovation as a whole, but there is distinct research on the meaning of technology and innovation.

First of all, technology is a form of knowledge (Dosi, 1984; Hall, 1994; Smith, 1996). According to Smith (1996), knowledge, in essence, is a special commodity with the apparent characteristics of public goods. With the nature of public goods, technological knowledge is independent in the context of transmission costs that can be neglected (Smith, 1996). This

feature is applied for the technological knowledge, whether in the practical form "related to concreate problems and devices" (Dosi, 1984, pp. 13-14) or in the theoretical form reflected in "know-how, methods, procedures, experience of successes and failure and also, of course, physical devices and equipment" (*Ibid*.).

The increasing of the stock of technological knowledge, naturally, generates the "effects of expanding the knowledge base" (Hall, 1994, p. 18), presented in the concrete form of technical change (Hall, 1994), which always leads to the economic situation of "higher productivity, the production of new goods or the improvement of existing ones" (*Ibid*., p. 18).

However, in technological innovation, the knowledge change is not gentle but violent, which is principally influenced by the nature of innovation of "creative destruction" (Elster, 1983; McCraw, 2007; Schumpeter, 1985).

Concerning the exploration of the nature of innovation, the most outstanding scholar is Schumpeter (Elster, 1983; McCraw, 2007). According to Schumpeter (1934), innovation is regarded as the new combinations of production means via creative destruction, serving as the engine of capitalist development (*Ibid*.) To achieve innovations, there are generally five channels, namely,

> the introduction of a new good; the introduction of a new method of production; the opening of a new market; the conquest of a new source of supply of raw materials or half-manufactured goods; the carrying out of a new organization of any industry. (Schumpeter, 1934, *cit.*, Elster, 1983, p. 116)

The process of innovation, therefore, determines the fact that the technological innovation is an original process of generating new technologies by means of creative destruction of the existing ones (Elster, 1983), and it is quite different from the technological imitation, which highly depends on the technology transfer and the host country's absorptive capacity (Madsen, Islam & Ang, 2010). Moreover, technological imitation usually happens in backward countries lacking the technological base to make innovation (*Ibid*.).

1.2.DETERMINANTS OF TECHNOLOGICAL INNOVATION

Based on the nature of technological innovation, it can be a complex phenomenon. The process is affected by various determinants, generally of two categories: endogenous and exogenous.

From the endogenous perspective, technological innovation is viewed as a learning process (Rosenberg, 1985). The viewpoint can be traced back to the classical period, in which Adam Smith (1976) found out that technical progress was mainly made by three types of learning processes: learning by using by specific workers, learning by doing through specialization in machine production, and formal or scientific learning (von Tunzelmann, 1995).

The aspect of the learning process cannot wholly explain the complexity of technological innovation. Based on the study of various scholars (Dosi, 1984; Hall, 1994; Mowery & Rosenberg, 1985), we have found that the exogenous determinants have two types, the technical-push with the focus on the function of science, and the demand-pull concentrated on the force of the market.

The technical-push treats science as an independent area to drive technology forward (Dosi, 1984; Hall, 1994). The view was added by von Tunzelmann (1995), with reference to Kuznets (1973, 1974), that "the emergence of modern science as the basis of advancing technology – a breakthrough in the evolution of science (…) produced a potential for technology far greater than existed previously" (p. 74).

However, Hall (1994) thought that technical-push is a typical linear model of science-technology-production without consideration of external marketing factors. Thus, the demand-pull emerged as a remedied theory.

Mowery and Rosenberg (1985) held that the market is "the causal prime mover" (p. 204) for technical progress. Specifically, the productive units recognize the market needs and make efforts to improve their technological activities to fulfill those needs (Mowery & Rosenberg, 1985).

With technological advancement and the emergence of sophisticated technologies, both the endogenous and the exogenous determinants encounter limitations. Thus, research and development (R&D), driven by the combined effects of the learning process and market motivations, has gained fame and popularity in academia (Belcher, Hassard & Procter, 1996).

1.3.DYNAMICS OF TECHNOLOGICAL INNOVATION

As with various other determinants, technological innovation evolves along with its logic and dynamics, which have been identified and studied in the literature (Dosi, 1984; Hall, 1994; Rosenberg, 1985).

First of all, technical change does not happen at random but in "a deep structure" (Hall, 1994, p. 28) determined by the existing technologies. This structure was defined as a technical paradigm by Dosi (1984) and Hall (1994).

The notion of the paradigm was first used in the history of science (Kuhn, 1970, *cit*., Hall, 1994), "thought of as a way of looking at the world (or part of it) which enables problems to be defined and research to be given pattern and structure" (p. 28).

Then, Dosi (1984) found a similar logic of paradigm in technical change, in which the techno-economic problems are resolved based on selected principles of the existing science and "specific rules aimed at acquiring new knowledge" (Hall, 1994, p. 29).

Within the technical paradigm, there always exists a momentum or direction (Dosi, 1984); that is to say, "once a path has been selected and established, it shows a momentum of its own" (*Ibid*., p. 17).

This momentum has been further named by Dosi (1984) as a technological trajectory; that is, "a normal problem-solving activity determined by a paradigm" (p. 17), can promote technological innovation by its driving force. But Hall (1994) pointed out that the trajectory can also turn into technological imperative, especially when it encounters "bottlenecks in connected processes and obvious weak spots in products" (Rosenberg, 1969, *cit*., Hall, 1994, p. 29).

In this condition, according to Dosi (1984), it is not easy to switch to an alternative one, and the only way to change paradigm is to "start (almost) from the beginning in the problem-solving activity" (p. 18).

Therefore, both the perspective of paradigm and trajectory concern the inner logic of technical progress. Besides the inner logic, technical diffusion is another dynamic and plays a role in promoting technical progress (Landau & Rosenberg, 1992; Rosenberg, 1985). The technical diffusion is motivated by the nature of goods of technology to realize its commercialization, or its economic values (*Ibid.*).

According to Rosenberg (1985), new technologies are invented in creating the first data of technological feasibility. Also, the diffusion of new technologies is a process of identifying their economic impact. Freeman (2004) adds that the diffusion process will lead to further innovation yet in "heavily skewed distributions of research, inventive and innovative activities" (pp. 550-551) and form clusters.

Landau and Rosenberg (1992) point out that the context of economic globalization has not only diversified the process of technological diffusion but also enhanced the role of the diffusion, especially in the form of technology transfer.

Technology transfer can help innovating countries "gain the competitive advantage" (Landau & Rosenberg, 1992, p. 4) and also permit recipient countries to have the late-comer advantage of "the ability to industrialize through borrowing rather than independent invention" (Rosenberg, 1985, p. 247).

1.4.ACTORS OF TECHNOLOGICAL INNOVATION

In the literature, there are generally two types of actors that dominate the process of technological innovation, the entrepreneurs and the state.

The entrepreneurs are considered as the main protagonists in the process of innovation (McCraw, 2007). Defined as the "new men" by Schumpeter (1983), the entrepreneurs, motivated by profit, act as the "pivot on which everything turns" (*cit.*, McCraw, 2007, p. 7) in the enterprises in whatever form or with whatever nature.

According to McCraw (2007), innovation serves as the motivation to gain higher profit for the entrepreneurs. Thus, there are two choices: that of the innovators who, to preserve high profit as long as possible, will utilize various mechanisms of protection, development, or publicity, specifically "through patents, further innovation, secret processes, and advertising" (p. 255); the non-innovators, on the other hand, will quickly react and try to imitate the innovation (McCraw, 2007).

However, Nelson and Wright (1992) thought that the Schumpeterian innovation mechanism centered on the competition was partial and limited without the consideration of the public side of technology. Thus, he pointed out, the process of innovation could be implemented by the mechanisms through which "new technical information is shared" (p. 58) and which "can be

used to pursue it cooperatively" (*Ibid.*) by various social institutions. Moreover, Nelson and Wright (1992) have emphasized the scientific contribution made by universities.

Compared with other social institutions, the firm, according to Hall (1994), can play a more active role in the realization of innovation, because as the "decision-making unit engaged in production" (p. 167), it can introduce new technologies into production in which "much new technology is developed in the pursuit of product and process innovation" (*Ibid.*). Moreover, it is usually "the quantity and timing of R&D undertaken within a firm" (*Ibid.*) that determine the speed of generating new technologies (Hall, 1994).

However, no matter how effective the mechanisms made by entrepreneurs or firms may be, they are still mainly affected by the national innovation policies (Fransman, 1994; Freeman, 2004; Malerba, 1992).

According to Malerba (1992), regarding the function of technological innovation, the public policy contributes as a principal force to "the organization of innovative activities and the commercialization of new technologies" (p. 264) through "mission-oriented programs" (p. 265), which can accumulate the forces from various institutions of "firms, research organizations, and universities" (p. 267) to focus on specific and essential technology.

Also, it is essential to note that public policies are different in different countries (Fransman, 1994; Malerba, 1992). Different from the bottom-up policies of European countries (Malerba, 1992), which emphasize "the establishment of technical standards, formation of human capital, the provision of technical information, and the diffusion of new technologies" (Malerba, 1992, p. 275), Japanese policies exert a stronger influence in the form of top-down or upstream (Fransman, 1994), reflected in the dominant occupation in R&D investment with a rate of nearly 90 percent by the government (Fransman, 1994).

2. TECHNOLOGICAL INNOVATION AND DEVELOPMENT

Technological innovation has always served as a driving force for development, which has been thoroughly discussed in the literature (Dosi, 1984; Folgieri, 2016; Lundvall, 2016; Schumpeter, 1985; von Tunzelmann, 1995). However, before exploring the connections between them, it is vital to know the nature of development.

2.1.NATURE OF DEVELOPMENT

Development is also a complicated issue in international politics. In the area of social science, there has been a variety of understandings about it with different emphases in its evolution for many years (Fuentes, 1993; Gilpin, 1987; Gustance & Hillier, 1998; Herath, 2009; Hosseini, 2003; Lin & Rosenblatt, 2012; Thomas, 2006; United Nations Development Program - UNDP, 2015).

The conventional development theory is born in Europe (Herath, 2009; Hosseini, 2003). It mainly concentrates on economic growth measured by the "positive change in real GDP (gross domestic product)" (Hosseini, 2010, p. 93), and on economic progress to accomplish "the growth of capitalism" (Herath, 2009, p. 1450), by resolving the problems of "urbanization, poverty and unemployment" (*Ibid.*).

However, in the "twentieth-century divergence" (Lin & Rosenblatt, 2012, p. 172) caused by industrialization, there emerged a division of developed and under-developed countries, with a more obvious gap after WWII (Herath, 2009; Hosseini, 2003; Lin & Rosenblatt, 2012).

Under this background, in what concerns the "Third World development" (Herath, 2009, p. 1452), a modernization paradigm has been proposed, which is constituted by "a process of emulation of the patterns of development previously experienced by the now so-called developed nations" (Blomstrom & Hettne, 1984, *cit*., Herath, 2009, p. 1452).

For the less developed countries (LDCs), however, the development issue is much more complicated than the one of growth, since it relies on the particular circumstances in society, politics, and economy (Hosseini, 2003). Thus, the economic development with the aim of "narrowing of the gap in per capita income between the rich and poor countries" (Lewis, 1944, *cit*., Hosseini, 2003, p. 93) is quite not sufficient for the LDCs (Hosseini, 2003).

As an alternative, the development economics born for the LDCs is much more practical, and are designed to deal with "the root causes of poverty and backwardness" (*Ibid*., p. 92) and finally contributes to the transformation of "poor/non-industrialized economies to developed/industrialized ones" (Hosseini, 2003, p. 93).

It is worth noting that in the process of transformation, the LDCs are likely to drop in the MIT (Gill et al., 2007). The MIT hypothesis was launched by the World Bank to indicate the risk that will be encountered by East Asian middle-income countries in transforming into high-income countries (*Ibid.*), as they are "squeezed between the low-wage poor-country competitors

that dominate in mature industries and the rich-country innovators that dominate in industries undergoing rapid technological change" (Garrett, 2004, *cit.*, Gill et al., 2007, p. 5).

The countries to be caught in the trap are probably caused by their lack in "institutions, capital markets, track record, or critical mass of highly skilled workers" (Flaaen, Ghani & Mishra, 2013, p. 1), or by the challenges of "distribution and social cohesion issues" (*Ibid.*). Besides these causes, the governments of these countries rarely shift from the "past successful policies" (*Ibid.*) or "exit prematurely from the industries that could have served as the basis for their specialization process" (*Ibid.*).

Besides the conventional development theories focusing on economic progress, the literature evolves with the notion of human development and sustainable development (Hossieni, 2010).

Human development is people-centered, a perspective that is enlightened by the UNDP in the Human Development Report (1997). In this Report, UNDP uses variables such as "life expectancy, educational attainment and real GDP per capita" (Herath, 2009, p. 1458) to build Human Development Index and Human Poverty Index to measure the development (Herath, 2009).

The sustainable development approach relates to development that integrates social, environmental, and economic factors (Thomas, 2006), relying on "using resources today without affecting the options for future generations" (WCED, 1987, *cit*., Fuentes, 1993, p. 576), aiming to achieve a balance between three objectives, namely, "maintenance of economic growth, protection of the environment and prudent use of natural resources, and social progress that recognizes the needs of everyone" (Custance & Hillier, 1998, p. 281).

2.2.TECHNOLOGICAL INNOVATION AND DEVELOPMENT

In promoting development, technological innovation is an effective instrument in the aspect of economic growth, economic structure, and sustainable development, which has been found and continuously deepened by many scholars (Alemu, 2013; Dosi, 1984; Folgieri, 2016; Fuentes, 1993; Gustance & Hillier, 1998; Hall, 1994; Lundvall, 2016; Murphy, Shleifer & Vishny, 1989; Schumpeter, 1985; Thomas, 2006; UNDP, 2015; von Tunzelmann, 1995).

2.2.1. IN ECONOMIC GROWTH

Among the elements that promote economic growth, technological innovation can serve as the principal driving force (Folgieri, 2016; Murphy, Shleifer & Vishny, 1989; Schumpeter, 1985; von Tunzelmann, 1995).

For Schumpeter, economic growth is the result of new combinations within the process of creative destruction (Elster, 1983). Thus, various methods of productivity are only differentiated by how the combinations are constituted and by the relations between the combining objects (*Ibid.*).

The driving dynamism of Schumpeterian innovation is not in linear but in circular flux, aiming to achieve the state of equilibrium: "it is a spontaneous and discontinuous change in the flow channels and in the disturbance of the equilibrium, which always change and move into the previously existing equilibrium state[1]" (Schumpeter, 1985, p. 47).

Schumpeterian innovation theory, developed for a capitalist society that has an established industrial base, is not appropriate for non-industrialized societies. Accordingly, for the relatively backward societies with small domestic markets, Rosenstein-Rodan (1943) proposed the concept of the big push (*cit*., Murphy, Shleifer & Vishny, 1989).

The big push occurs "if various sectors of the economy adopted increasing returns technologies simultaneously, they could each create income that becomes a source of demand for goods in other sectors, and so enlarge their markets and make industrialization profitable" (Rosenstein-Rodan, 1943, *cit*., Murphy, Shleifer & Vishny, 1989, p. 1004).

For Murphy, Shleifer, and Vishny (1989), the process of simultaneous industrialization is mainly driven by promoting domestic demand while ignoring the function of exporting growth.

The technological innovation contributes to economic growth mainly by increasing the productivity, which will necessarily generate new technologies and upgrade the existing machines, with a direct function of "facilitating and abridging labor" (von Tunzelmann, 1995, p. 39).

[1] Translated by the author from the original version of "*é uma mudança espontânea e descontínua nos canais do fluxo, perturbação do equilíbrio, que altera e desloca para sempre o estado de equilíbrio previamente existente*".

However, in the meantime, it shall cause the anxieties of technological unemployment (Folgieri, 2016; von Tunzelmann, 1995) by reducing the necessary working hours occupied by human workers (Folgieri, 2016).

This anxiety is, nevertheless, temporary and should be analyzed in a farsighted way. Concerning David Ricardo (1817) and Marx (1887, 1965), von Tunzelmann (1995) explained that in the process of mechanization, generally, labor will be relocated by the 'invisible hand' and in the end, receive higher wages.

2.2.2. IN ECONOMIC STRUCTURE

Besides economic growth, technological progress proceeds toward the structural equilibrium and sustained growth through adjusting the demand and supply side (Dosi, 1984; Hall, 1994), mainly reflected in the development of external and knowledge economy (Alemu, 2013; Hall, 1994; Lundvall, 2016).

For a nation, the external economy is primarily determined by the comparative advantage (Freeman, 2004; Gereffi, 1999). Technological innovation is precisely the factor that can determine "how comparative advantage changes" (Hall, 1994, p. 392).

Specifically, technical progress will expand production possibilities and increase the production possibility frontier or technology frontier (Hall, 1994), which enables a nation to gain competitiveness in the global trade through "reaching a higher terms of trade line than before" (Hall, 1994, p. 392) or upgrading the position in the global commodity chain (Gereffi, 1999).

Naturally, for the firms, the main actors of the trading economy will also gain the capacity to have new products or improve the existing ones so that they can maintain profits and competitiveness in the trade (Alemu, 2013).

Different from the viewpoint of comparative advantage, Freeman (2004) holds that a nation can enhance international competitiveness by a national innovation system. Specifically, a nation can make long-term investments in technological infrastructure (R&D) or promote technical innovation to minimize the technological gap, increase technical output, and finally enhance its competitiveness (*Ibid.*).

Moreover, he points out that once the country gains technological leadership, it will obtain "absolute rather than comparative advantage" (p. 541).

However, the positive effect of technical innovation for the external economy does not always work out efficiently, as the comparative advantage is not static but "dynamic and ever-changing" (Landau & Rosenberg, 1992, p. 114), and growth itself is "a highly path-dependent experience" (*Ibid*.).

Besides the external economy, technological innovation also acts as an essential role in building up a knowledge-based economy, which is a form of modern economy involving the processes of "creation, acquisition, dissemination, and utilization of knowledge" (Kumar & van Welsum, 2013, p. 5).

The knowledge economy, defined by Powell and Snellman (2004) as "production and services based on knowledge-intensive activities" (p. 199), is driven by the development of "research and development, education, and learning on the job" (Kumar & van Welsum, 2013, p. 5). For Jensen, Johnson, Lorenz, and Lundvall (2016), this economy is centered on science, technology, innovation, and the learning process.

With reference to Chen and Dahlman (2005), Kumar and van Welsum (2013) point out that there are four pillars to measure the knowledge economy: "Economic Incentive and Institutional Regime (policies and institutions for the protection of IP, the rule of law, the ease of starting a business), Education (human capital), Innovation (universities, firms, and research institutes, similar to organizational capital), and ICT (physical capital)" (p. 6).

However, for the knowledge production-centered ideas, Powell and Snellman (2004) argue that knowledge dissemination and impact should be given more attention and, thus, point out that intellectual capabilities are much more critical than physical inputs for the establishment of a knowledge economy, and patents can be "an appropriate measure of stocks of knowledge" (p. 215).

Moreover, there is a growing literature that focus on the issue of promoting the developing economy (Lu, Zhang & Wang, 2010; Xu, Liu & Chen, 2002; Asian Development Bank-ADB, 2007) through establishing the knowledge value chain, including "knowledge input, knowledge activities, knowledge output and knowledge innovation of service enterprise" (Lu, Zhang & Wang, 2010, p. 3033), improving the knowledge management, and finally, enhancing the competitive advantage in knowledge.

2.2.3. IN SUSTAINABLE DEVELOPMENT

A sustainable economy is characterized by the careful consideration of social, environmental, and economic factors and can realize the purposes of environmental protection and social progress in the process of economic growth (Fuentes, 1993; Gustance & Hillier, 1998; Thomas, 2006; UNDP, 2015).

Technological innovation can maintain sustainable development, as it can "further accelerate production and spur economic growth" (Santana, Rebelattto, Périco, Moralles & Filho, 2015, p. 425).

Moreover, technological innovation can contribute to reducing negative impacts of industrial progress on society and nature through its constantly generating "new production alternatives" (*Ibid*.); ensure "a qualitative leap in environmental efficiency" (Fokkema et al., 2005, *cit*., Santana et al., 2015, p. 429); promote "economic vitality, environmental sustainability and social progress" (Santana et al., 2015, p. 429) to enhance the pillars of sustainability (Santana et al., 2015).

Fuentes (1993) and Kim (2011) contribute a viewpoint of green technology to promoting an environmental-friendly economy, which refers to "product, service, or process that delivers value using limited or zero non-renewable resources and/or creates significantly less waste than conventional offerings" (Pernick, 2007, *cit*., Kim, 2011, p. 15).

2.3.TECHNOLOGICAL INNOVATION IN THE INTERNATIONAL CONTEXT

In the international context, marked by globalization of an "economic, political, and social integration of states and societies, both horizontally and vertically, in tighter webs of interdependence" (de Soysa, 2003, p. 7), the most apparent way of technology transfer is a foreign direct investment (FDI) (Girma, Gorg & Pisu, 2008; Haggard & Cheng, 1992; Kostevc, Redek & Rojec, 2011; Ray, 1977). In this context, IP has played the role of legal protection (Lamberton, 1994; Teece, 1992).

The FDI emerges as an instrument for multinational companies (MNCs) to maximize their profits (Ray, 1977). The MNCs, constituted by domestic oligopolies, view FDI as an alternative to "capture monopoly profits abroad" and to "maintain market positions abroad as alternative suppliers in the local market itself and other foreign countries become more competitive" (*Ibid.*, p. 284).

Also, they usually have relatively superior 'firm-specific assets' (FSA) concerning production techniques, know-how, or management strategy (Caves, 1996, *cit.*, Girma, Gorg & Pisu, 2008). The FSA has some of the characteristics of public good and can enable the firm to locate profitably abroad (*Ibid.*).

Considering the nature of public good, the FSA is difficult to protect by MNCs (*Ibid.*) in recipient areas with a technology gap (Girma, Gorg & Pisu, 2008). Local firms will use it once it is out on the external market (Caves, 1996, *cit.*, Girma, Gorg & Pisu, 2008). Thus, the positive spillovers generate and help the recipients improve productivity (Girma, Gorg & Pisu, 2008).

Besides spillovers, the recipient areas can be included automatically in the global value chain (GVC) by absorbing FDI, owing to "differentiated manufacturing processes integrated globally by the multinational corporation" (Frobel, 1981, *cit.*, Haggard & Cheng, 1992, p. 91).

To attract FDI, the receiving areas need to provide a good investment environment, not only in specific FDI policies but also in an adequate "regulatory-administrative and economic policy framework" (Kostevc, Redek & Rojec, 2011, p. 173).

However, the positive spillovers can be mitigated by the increased competition generated by foreign companies, which may actually result in adverse effects on domestic firms' productivity "if multinationals 'steal business' from domestic firms and force them up their average cost curve" (Aitken & Harrison, 1999, *cit.*, Girma, Gorg & Pisu, 2008, p. 324).

In this condition, legal protection is necessary, which is always in the form of IP, indicating a "wide range of rights that are conferred by the legal system about discrete items of information that have resulted from some form of human intellectual activity" (Ricketson, 1992, *cit.*, Lamberton, 1994, p. 301). These activities include inventions, scientific discoveries, literary and artistic works, trading marks, and industrial designs (Lamberton, 1994).

According to Teece (1992), IP can help innovators maintain the 'first-mover' advantages, and guarantee them with new products and know-how winning in the market.

However, IP protection is not easy. Unlike machines with clear rights of ownership, the know-how and skills, are intangible and quickly encounter being codified by others to save the high innovation costs (Teece, 1992; Lamberton, 1994), unless they fall into some of the categories of IP, "patents, copyrights, trade secrets, trademarks" (Teece, 1992, p. 177), in which the

innovation can be established with a case title, recognized with rights of assignment and finally obtain a limited protection (Teece, 1992).

3. TECHNOLOGICAL INNOVATION AND POWER

International politics, according to Morgenthau (1985), share the nature of all politics of "a struggle for power" (p. 31) by nations in the political order. The technological innovation has been utilized by nations not only as the traditional military instrument (Greenwood, 1990; Koubi, 1999; Shimshoni, 1990-1991) but also as an instrument to exert foreign policy (Colglazier & Lyons, 2014; the Royal Society, 2010) to gain power (attractiveness) and enhance positions in world order (Gardner, 1998; Rosenberg, 1985; Song, 2016).

3.1.NATURE OF POWER

First of all, power can be perceived as force or capacity (Hobbes, 1651/2005), a perspective relatively static, belonging to the natural power defined by Hobbes (1651/2005), which contains "eminence of the faculties of body, or of mind; (as) extraordinary strength, beauty, prudence, capacity, eloquence, liberality, or nobility"[2] (p. 83).

Hobbes (1651/2005) also points out that attractiveness, the quality that makes other people love, can also constitute the element of power; that is, "what quality makes a man beloved or feared of many, is power because it is a means to have the assistance and service of many"[3] (p. 84).

However, both Boulding (1990) and Viotti (2001) held that capabilities could not be equated with power and only if they can execute influence over others through their distribution. This kind of power was named by Hobbes (1651/2005) as instrumental power to gain more power, or in international politics, utilized by a state to "influence or to coerce the behavior of another state or actor" (Viotti, 2001, p. 86).

The effects of the distribution of capabilities, depending on the instruments and ways adopted by the actor, ultimately divide instrumental power into two categories: hard power and soft power (Boulding, 1990; Nye, Jr., 2004; Russell, 1990; Viotti, 2001).

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[2] Translated by the author from the original version of "*eminência das faculdades do corpo ou do espírito; extraordinária força, beleza, prudência, capacidade, eloquência, liberalidade ou nobreza*".
[3] Translated by the author from the original version of "*qualquer qualidade que torna um homem amado, ou temido por muitos, é poder; porque constitui um meio para adquirir a ajuda e o serviço de muitos*".

Hard power, also known as crude power (Morgenthau, 1985), mainly exerts influence through threats or payments (Nye, Jr., 2004) and exist in the specific forms of military and economic power.

Military power, as a destructive power, is always associated with the behavior of threat ("sticks") (Boulding, 1990, Nye, Jr., 2004) and is "the most important factor making for the political power of a nation" (Morgenthau, 1985, p. 33).

Economic power, as exchange power, exerts influence through inducements or payments ("carrots") (Boulding, 1990; Nye, Jr., 2004), the process of which always involves bargaining (Boulding, 1990). In some conditions, the implementation of economic power needs some destructive element, serving as an instrument to promote the "development of a system of a law" (Boulding, 1990, p.28) as well as an instrument of punishment "for failure to live to contracts and (…) for failure to obey the principle of property" (*Ibid.*).

However, not all the influences can be obtained by hard power, and not all the hard power can reach the purposes, as hard power has limitations in exerting influence (Nye, Jr., 2004).

Nye, Jr. (2004) has remedied this condition by revealing the second face of power, namely soft power, which "co-opts people rather than coerces them" (p. 5) to attain the objectives. It usually tends to "shape the preferences of others" (*Ibid.*) with "intangible assets such as an attractive personality, culture, political values and institutions, and policies that are seen as legitimate or having moral authority" (Nye, Jr., 2004, p. 6).

Soft power engenders not only influence (Nye, Jr., 2004) but also an attraction, love, or respect related to "the integrative structures of pride and shame and perhaps guilt" (Boulding, 1990, p. 29).

3.2.TECHNOLOGICAL INNOVATION AND POWER

It is noted that technological innovation is an effective way to increase economic capacity. Furthermore, technical progress is likely to be used to enhance military instruments, which is directly connected to a nation's military strength (Bas & Coe, 2012; Hurlburt, 1979; Koubi, 1999; Lautenschlager, 1985). More recently, technological innovation has been expanded to include the function of building up national attractiveness through science diplomacy (Colglazier, 2016; Colglazier & Lyons, 2014; Leijten, 2017; the Royal Society, 2010).

3.2.1. IN MILITARY CAPACITY

Military technology has strategic importance for a nation, especially in wartime. According to Shimshoni (1900-1991), the qualitative nature of prevailing technologies determines the advantage of a nation. This was demonstrated by the technologies of the time during the First World War, like "railroads, machine guns, barbed wire" (Shimshoni, 1900-1991, p. 189), and the emergence of "nuclear threshold concept, laser-guided weapons, space surveillance systems" (Hurlburt, 1979, p. 108) in the Second World War (WWII).

Besides their importance in wartime, Koubi (1999) indicates that military-use technologies have the potential to affect the international distribution of power. Bas and Coe echoed this viewpoint in 2012 with their ideas of that one state can invest in acquiring new military technologies to shift the balance of power. In this sense, a race for technological superiority among superpowers is likely to happen (Koubi, 1999), as their relative or absolute positions in the technological ladder can influence "the intensity of competition and hence the rate of introduction of new weapons" (*Ibid.*, p. 540).

Notwithstanding that the military technologies have been identified with negative impacts after witnessing the emergence of lethal and destabilizing weapons in history (Hurlburt, 1979; Lautenschlager, 1985; Shimshoni, 1990-1991), the literature (Greenwood, 1990; Lautenschlager, 1985) argues that it is difficult to restrain military instruments even under arms control agreements.

The difficulty has two reasons: one is that the complexity of technological development makes it hard to identify the items to be controlled (*Ibid.*); the other is that military technologies have the apparent effects of "enhancing capabilities and cost-effectiveness (in performing missions); outperforming potential adversaries; symbolic roles; and preserving or improving stability" (Greenwood, 1990, p. 417).

3.2.2. IN SCIENCE DIPLOMACY

Science diplomacy emerges owing to the science and technology (the S&T) development and innovation that has affected "the relative importance of local, national, and transnational groups in world politics" (Fox, 1968, p. 3). The S&T is not only the indicator of national capacity but also the instrument to resolve problems among nations (Fox, 1968; Krige & Barth, 2006;

Mashelkar, 2017). In this sense, the traditional arms race among nations has given way to the S&T competition (Fox, 1968).

The viewpoint of science diplomacy was first given by the Royal Society in 2010. They held that science is a source of soft power achieved by the channels of the scientific community in resolving "problems of common interest" (p. 15) beyond national boundaries; and of foreign policy utilizing the scientific exchange to implement "coalition-building and conflict resolution" (*Ibid*.).

The Royal Society (2010) further divided the science diplomacy into three types, namely, science in diplomacy, diplomacy for science, and science for diplomacy, specifically, "informing foreign policy objectives with scientific advice; facilitating international science cooperation; using science cooperation to improve international relations between countries" (p. 15).

Colglazier (2016) has contributed to the notion proposed by the Royal Society by combining science in diplomacy and science for diplomacy as a category of "science leaping over diplomacy" (no page), which has the essence of recognition of the science that can "create new pathways for making progress" (*Ibid*.) on the problems whether national, regional, or global, that are difficult to be resolved by the conventional means.

Different from the perspective of the Royal Society, Leijten (2107) argues that science diplomacy is distinguished from the diplomacy for science, as it emphasizes "the use of the 'soft power' of scientific collaboration to smoothen the political relations" (p. 1) between countries.

For Leijten (2017), science diplomacy has been shifted to innovation diplomacy because of the tendency for an increasingly important role of knowledge in international relations. "The growth of the knowledge economy is pushing strategies and policies for a knowledge-based competition to the center of the scene, not only in national politics but also in foreign policy" (p. 13). Thus, it is useful for talking about innovation diplomacy, which encompasses science, technology, and their diffusion (Leijten, 2017).

3.3.TECHNOLOGICAL INNOVATION AND WORLD ORDER

Technological innovation can affect the formation of political power. Thus, it has an indirect connection with world power distribution, specifically, the formation of world order.

3.3.1. NATURE OF WORLD ORDER

Ikenberry (2011) views the world order as "a hierarchical political order with liberal characteristics" (xi). It is a U.S.-led liberal hegemonic order (Ikenberry, 2011). Specifically, America led its allies to build up the order organized around "economic openness, multilateral institutions, security cooperation, and democratic solidarity" (Ikenberry, 2018, p. 7).

The Cold War's conclusion has made the order distribute worldwide, and America, as the leader of the order, has obtained world hegemony. Since then, to the wider liberal order, America has fused its "political system, (…) alliances, technology, currency, and markets" (Ikenberry, 2011, p. 2).

More scholars have echoed the viewpoint of a liberal order. Hu and Spence (2017) adds that the order is "an open system for trade in goods and services, supported by international institutions" (p. 54), allowing a relatively free-flowing across the border of capital, corporations, and people, which indirectly promotes a rapid spread of data and technology and highly improves the global living standards (Hu & Spence, 2017).

However, the postwar liberal order, or 'World Order 1.0,' as named by Haass (2017) has become inadequate after various international problems have emerged, such as the affluence of tourists, the presence of terrorists and refugees, and the emergence of protectionism, nationalism, and populism (Haass, 2017; Hu & Spence, 2017; Nye, Jr., 2017).

Moreover, the U.S., as the traditional provider of global public goods (Nye, Jr., 2017), "loses interest in nurturing the international order" (Hu & Spence, 2017, p. 55). Moreover, the world is undergoing "the passing of the American era of dominance" (Ikenberry, 2011, p. 4). At the same time, the new powers like China and India continue to grow and are likely to become the order challengers (Nye, Jr., 2017).

Faced with an order crisis, Ikenberry (2011) assumed that maintaining the order will necessitate "a new bargain" (p. 7) among the major powers. Meanwhile, for Haass (2017), the 'World Order 2.0' is necessary to "expand and adapt the traditional principles of the international order for a highly interconnected world" (p. 2). In addition, new powers, like China, have to solve

problems to “replace the US as the sponsor of an open, multilateral order” (Hu & Spence, 2017, p. 55).

3.3.2. DIVISION OF POWER IN THE WORLD ORDER

In world politics, the nations are generally classified into developed, developing, and underdeveloped (de Soysa, 2009) according to comprehensive national strength. However, according to the interactions with the world order, the countries can be divided into three levels: primary operator, coordinator, and performer.

To put it specifically, the U.S., as the absolute principle contributor of the order (Gilpin, 1987; Rosenberg, 1985), ranks at the first level; Japan, a successful “latecomer,” ally of the U.S., and the coordinator of the order (Frankel, 2015; Gardner, 1998; Payne, 2008; Tang, 2011), ranks at the second level; and the rest of the countries in development that are aiming to catch up with the developed ones (Gardner, 1998; Song, 2016) are primarily performers within the order (Vezirgiannidou, 2013) and rank at the third level.

Since 1945, the U.S. has gained technological dominance transferred from Britain, as it gained the pioneering position in structural transformation involved in shifting to new industries (Rosenberg, 1985). The superior position in mass production industries and high-technology industries have constituted American technological leadership (Nelson & Wright, 1992; Rosenberg, 1985).

The technological leadership has contributed to America’s hegemony (Gilpin, 1987). Naturally, the U.S. is the “hegemonic organizer and manager” (Ikenberry, 2011, p. 2) of the order.

As one of the pillars of American technological dominance, the high-technology industries commonly involve high development costs to maintain and higher costs to move toward higher performance levels (Rosenberg, 1985).

The logic also applies to maintaining America’s dominating position in the world order. In the process of maintaining hegemony and sustaining liberal order, the U.S. has accumulated a huge foreign debt and encountered a productivity decline, a trade surplus, and competitive economies (Gilpin, 1987) until found itself caught “between its many commitments and decreased power, the classic position of a declining hegemon” (Gilpin, 1981, *cit.*, Gilpin, 1987, p. 347).

Relative to America's industrialization, Japan is a latecomer (Gardner, 1998). In the late nineteenth century, Japan established a modern world through rapid industrialization, specifically by opening itself to foreign trade, attempting to close the technology gap, establishing state-run businesses, and supporting private industry (Gardner, 1998; Tang, 2011). Though the modern Japanese economy was destroyed by the devastation of WWII, it still made use of its conditions to create a growth miracle and then became the second-largest industrial country (Gardner, 1998).

This economic miracle has mostly benefited from Japan's being an American ally. Thus, Japan has not only obtained access to "U.S. markets for industrial products, technologies, and investment" (Heginbotham & Samuels, 1998, p. 176) but also turned into a coordinator of the order. With America's support, Japan became one of the members of Group Five (G5) led by America (Payne, 2008; Frankel, 2015).

Japan is a successful catching-up country owing to its earlier establishment of an industrial base (Gardner, 1998; Song, 2016).

At present, the 'catching-up' countries are mainly constituted by emerging economies that are struggling to change the situation of technological laggards (Song, 2016). These countries always have a technology gap. Even so, they can benefit from global technological diffusion and obtain "technological advances made by first-comer countries" (Gerschenkron, 1962, *cit*., Perkins & Neumayer, 2005, p. 791) through the direct methods of FDI or technology purchase, which are generally executed under national incentive strategies or indirect ways of knowledge spillovers (Bell & Pavitt, 1997; Hayter & Edgington, 2004, *cit.*, Perkins & Neumayer, 2005; Song, 2016).

Having gained the emerging capacity in the process of 'catching-up,' the countries have been named new powers, "not traditional U.S. allies" (Vezirgiannidou, 2013, p. 635). They have contributed to the reinforcement of the multilateral world order (Vezirgiannidou, 2013).

In the hierarchical order, it is difficult to change the existing ranking. According to the power transition theory, power shifts may lead to conflicts or war, namely, "shifts in power, most caused by rapid economic growth in one party relative to a hegemonic status quo power, is likely to lead to war" (Foot, 2017, p. 830).

As developed from the power transition model (Lee, 2019), American scholar Allison in 2015 coined the term “Thucydides Trap” to emphasize the instability that occurred in the relations between the U.S. and China led by a structural change that was caused by China’s rise.

However, Zhang (2019) held that Allison’s trap “highlights the emotional changes induced by the shifting balance of material capability” (p. 130), and emphasizes “irrationality of behavior” (p. 132). He then added that the trap theory is different from the power transition theory, which “assumes that states make rational calculation of power and interest” (*Ibid*.).

It can be found that both the origins of the theories and their cases have centered on a capitalist background and a liberal economy. They have not provided the experiences of a non-capitalist developing country and analyzed it to see if it can make use of technological innovations to maintain development and achieve strategic rising in the world order.

In the second part, therefore, we will focus on the case of China and will testify if the mechanism of technological innovation can still be useful for China in promoting its development and accelerating its rising position in international politics.

PART 2 MIC2025: CHINA'S DEVELOPMENT STRATEGY THROUGH TECHNOLOGICAL INNOVATION

1. THE DUAL INSTRUMENTAL FUNCTION OF MIC2025

In May 2015, CSC issued the document *Notice of the State Council on Issuing the "Made in China (2025)"*[4]. MIC2025 is a manufacturing plan that will help China build up "a powerful manufacturing industry" (CSC, 2015, no page). Implementing the plan is "the only way" (*Ibid.*) for China to "upgrade comprehensive national competitiveness, guarantee national security, and finally become a global power" (*Ibid.*).

China made the MIC2025 its industrial upgrade plan with several considerations.

According to the CSC's *Notice*, China is still in the process of industrializing and confronting itself with a large gap in relation to industrialized countries in technology. This gap can be demonstrated by China's high dependence on other countries in terms of core technologies and equipment of high technology (*Ibid.*).

On the other hand, there is currently a worldwide tendency to readjust national manufacturing chains that is motivated by the increasing combination of information technology and manufacturing. This tendency can be proven by the emergence of re-industrialization plans made by the majority of G7 members, the traditional industrial countries (see Table 1).

[4] The document has the original name in Chinese as, *"国务院关于印发《中国制造 2025》的通知"* (*Guowuyuan guanyu yinfa "zhongguo zhizao 2025" de tongzhi*).

Table 1 Re-industrialization plans of traditional industrial countries

Country	Re-industrial policies	Launching date
America	*A National Strategic Plan for Advanced Manufacturing*	February 2012
French	*New Industrial France program*	September 2013
Germany	*Industry 4.0 for the digital transformation of manufacturing*	October 2013
Japan	*Society 5.0 for a digital transformation across all levels of the Japanese society*	January 2016
Great Britain	*Manufacturing the Future Initiative*	April 2011
	Industrial plan of Building our Industry Strategy (in Green Paper)	January 2017
Italy	*Industrial National Plan 4.0*	September 2016

Source: Compiled by the author with the data collected from Xue et al. (2018).

Therefore, MIC2025 is intended to put China on an accelerated path to industrialization. With this plan, China can achieve three transformations, namely, "from being made in China to be created in China; from the title of China's speed to the one of China's quality; from the presence of China's products to one of China's brands" (CSC, 2015, no page).

However, the plan is quite different from China's traditional industrial plan[5], which has a short period and concentrates on specific projects. MIC2025 will last till 2049, the 100th anniversary of the People's Republic of China. Thus, it is not merely a manufacturing plan, but rather a strategy that leads to the *China Dream*.

The *China Dream* (*Zhongguo meng*) is a concept that was formally brought forth in the Eighteenth National Congress of the Communist Party of China (the 18th NCCPC) on 29 November 2012, becoming an essential part of the ideology of Xi Jinping (People.cn, 2017).

The dream indicates the great rejuvenation of the Chinese nation. More precisely, it will implement the goals of "two 100s" (*liangge yibainian*): one is that China becomes a moderately well-off society (*xiaokang shehui*)[6] by the year 2021, the 100th anniversary of the Chinese

[5]. The traditional industrial plan is made up of a five-year plan, which is short for the five-year plan for the national economy and social development of PRC, constituting an essential part in China's national economic development plan. It is concentrated on major national projects, distribution of production force, and organization of relations among different units of the national economy. In 1953, the government made the first five-year plan. In the current period, China is in its 13th five-year plan.

[6] Moderately well-off society was the first goal that was first proposed by Deng Xiaoping on 6 December 1979, indicating modernization of China, specifically that China's per capita GNP would reach U.S. $800 at the end of the twentieth century.

Communist Party; the other is that China becomes a fully modernized nation (*qianmiande xiandaihua guojia*)[7] by 2049, the 100th anniversary of the People's Republic of China.

According to the Chinese government (*Ibid.*), a modernized China will regain its position as a leader in S&T as well as in economics and business; as such, there will be a resurgence of Chinese civilization along with its cultural and military might. Also, China can participate actively in all areas of human endeavor. In this sense, China will attempt to become a global power via modernization.

In order for China to become a global power, MIC2025 has a three-step timeline in manufacturing terms. Namely,

- By 2025, China will improve the informatization of manufacturing industries and have several MNCs and industrial clusters with global competitiveness, helping China rise in the GVC.
- By 2035, China will accomplish industrialization and have some core technologies in key industrial sectors; thus, it will obtain a leading position in competitive industries.
- By 2049, China will have an advanced industrial system and will stand on the technological frontier and thus will become a manufacturing power.

Therefore, the CSC has given MIC2025 the nature of a dual instrumental function in the very beginning; here, we speak of an industrial upgrade plan with the strategic goal of fulfilling the *China Dream*.

With this strategic purpose, the government has listed ten sectors (see Figure 3) on the *Technology Roadmap of Key Sectors of MIC2025* (the Roadmap), which was launched shortly after the Notice (in October of 2015).

[7] To become a fully modernized nation was the second goal that was initiated formally in the 19th National Congress of the CPC in October 2017.

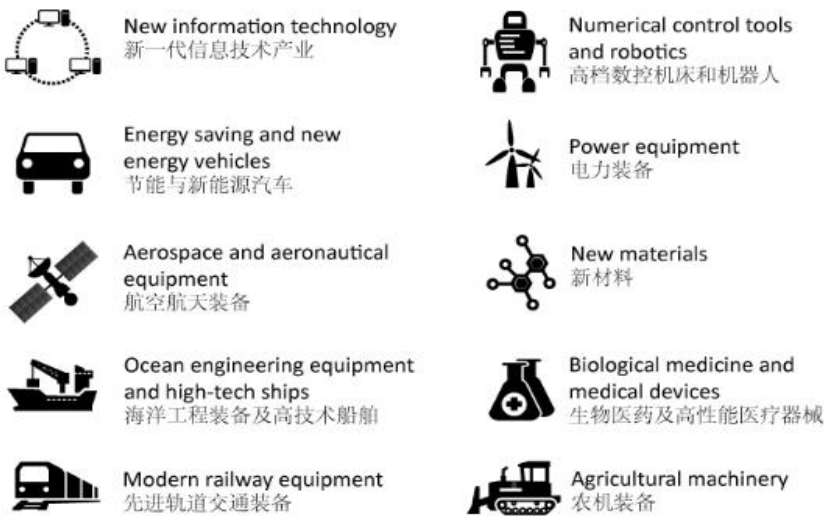

Figure 3 Ten critical sectors of MIC2025

Source: http://www.catl.org.cn/2016-05/05/content_38388927.htm

New information technology has been given priority on the list as it is closely related to the fourth industrial revolution. This revolution emphasizes smart manufacturing by connecting machines, items, and employees in virtual reality by means of the Internet of Things (IoT) (Szozda, 2017). This virtual reality functions by digital connections; thus, information and communication technology (ICT) will "dominate future business models" (*Ibid.*, p. 401). In other words, ICT is crucial for global competitiveness for nations.

In the Roadmap of 2015, China listed three items for ICT, namely, wireless communication technology, new-generation networks, and high-performance computers and servers (National Manufacturing Strategy Advisory Committee - NMSAC, 2015). However, in the renewed Roadmap of 2017, the ICT was reduced to two items: wireless communication technology and new-generation networks (NMSAC & Chinese Academy of Engineering - CAE, 2017).

Both items have the same structure, including demand, goals, key products, key technologies, application projects, and political supports. Thus, we have selected the wireless communication technology industry to analyze the nature of its innovation.

Technological innovation is an original process of generating new technologies through the creative destruction of the existing ones (Elster, 1983). Thus, innovators can produce new goods and obtain a higher productivity (Hall, 1994).

Wireless communication technology has the nature of technological innovation. Per figure 4, China will make use of its current communication technologies and industrial base to achieve the informatization of manufacturing processes. Based on accumulated communication technologies, China will likely become one of the leading introducers of the new generation of networking, 5G, and to open and occupy new markets (NMSAC, 2015).

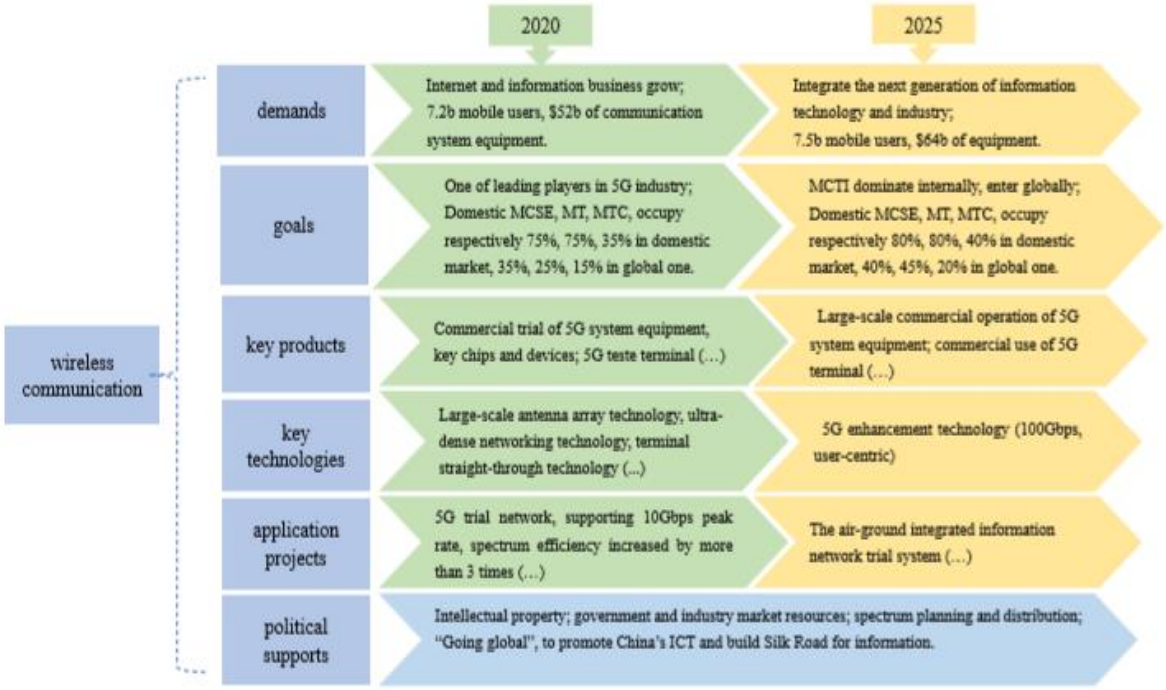

Figure 4 Technology roadmap for the wireless communication industry[8]

Source: Translated by the author with the figure from Roadmap 2015 from NMSAC

Regarding the determinants of technological innovation, this technology is highly influenced by demand. Namely, there is a growing need for wireless mobile communication worldwide, with an estimated 7.2 billion users in 2020 and 7.5 billion users in 2025 (*Ibid.*).

On the other hand, it is also designed to help China achieve a strategic rise in global technological ranking. China may become one of the countries making 5G standards until 2020 (*Ibid.*).

With a forceful strategic push, the Chinese government will become the main actor. It will offer preferential policies regarding industrial resources and assistance of internalization for the

[8] To save the space, the author has used some abbreviations in the figure. They are MCSE for mobile communication system equipment, MT for mobile terminals, MTC for mobile terminal chips, and MCTI for mobile communication test instruments.

accomplishment of the roadmap. As shown in the figure, the wireless communication industry will obtain preferences in the distribution spectrum (one ICT resource) and will enjoy the "going global" policy (*Ibid.*).

From this industry's roadmap, it can be noted that MIC2025 is highly dependent on technological innovation and is heavily mission-oriented.

MIC2025 offers an innovation-driven trajectory for China's prospective development, which is quite different from China's current trajectory that depends on exports and investment. As every trajectory has momentum once it has been selected and established, it is not easy to shift to an alternative (Dosi, 1984; Hall, 1994). Thus, it is doubtful that China can successfully shift from the current trajectory to the new one.

On the other hand, MIC2025 has a strategic mission of achieving "self-sufficiency" (CSC, 2015, no page) of basic components of the manufacturing industry. Specifically, by 2020 and 2025, China can independently produce core components, with a percentage of 40% and 70% respectively. Generally, China will have "a clear decline in dependence on core foreign technologies" (*Ibid.*). Thus, it is possible that China, with more technological independence, will shift from multilateralism to unilateralism or protectionism.

These analyses lead to the basic research question: *Is the MIC2025 with a dual instrumental function, an instrument for China's development strategy in order to enhance its position in the world order*?

Accurately, the next section (section 2) will analyze the conditions of China's shifting to an innovation-driven trajectory, and if successful, it will place the country on the path of sustainable development; if not, China might fall into the MIT. The following section (section 3) will analyze if China can use its rise to contribute to a multilateral word or drop in the TT.

2. PROSPECTIVE CHINESE DEVELOPMENT: MIT OR SUSTAINABLE DEVELOPMENT?

2.1. RISK OF FALLING INTO THE MIT

In 2010, China became the world's second-largest economy measured by GDP, attributed to its GDP-centered development model. However, it is still a middle-income country measured by GDP per capita of U.S. $4382 (Cai, 2012).

Various phenomena have emerged indicating that China's comparative advantages have been "squeezed between the low-wage poor-country competitors that dominate in mature industries and the rich-country innovators that dominate in industries undergoing rapid technological change" (Garrett, 2004, *cit.*, Gill et al., 2007, p. 5). Specifically, China has been experiencing an economic slowdown, various environmental problems, severe development disparity, and a gradually aging society. Under these circumstances, it can be noted that China's traditional development model has been exhausting its effectiveness and will probably lead China to the MIT.

First, China's economy is slowing down. In 2012 (see Figure 5), China's GDP growth rate dropped below 8%, which is a long-term economic growth target for China (People Daily, 2017). Since then, the economy has maintained its declining momentum and remained in a mid- and low-rate speed.

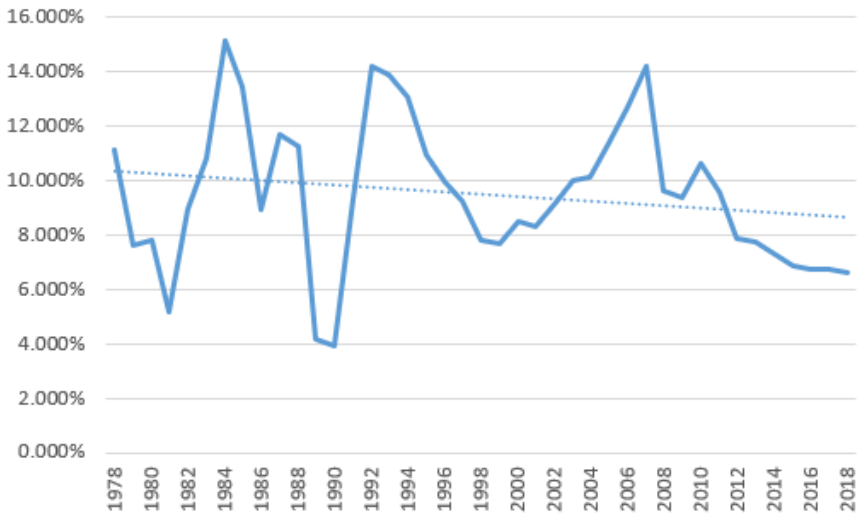

Figure 5 Trend of the growth rate of China's GDP in 1978 – 2018

Source: Made by the author with the data collected from the World Bank site

Besides economic slowdown, the traditional development pattern, which is highly dependent on investment and exports, has generated a variety of problems both in environmental sustainability and social justice.

In China, investment mainly goes in the direction of energy industries such as coal, steel, and cement, which can generate rapid GDP growth. Thus, they are mainly located in the resource-rich areas, like China's west, northeast, and northwest. The emphasis on energy and

infrastructures has maintained a vital share in China's total investment, keeping in a proportion of 8% until 2010 (see Figure 6).

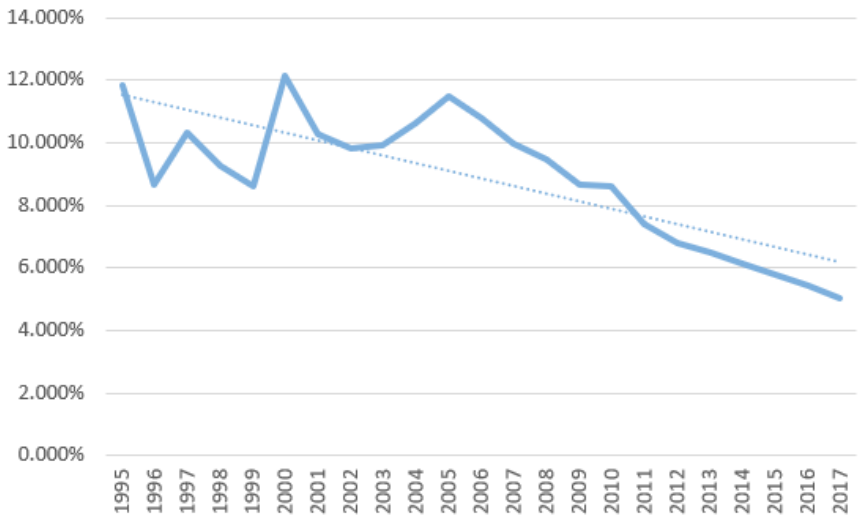

Figure 6 Share of investment in energy industries in total investment

Source: Made by the author with the data collected from the NBSC site

Different from the concentration of energy industries in inland areas, the export industries are located mainly in southeast and coastal areas, as they are the destination of the majority of FDI in China. In these areas, companies mainly export products by processing and assembling, which is highly dependent on human resources.

Both methods of production have resulted in environmental problems. In inland areas, the energy industry and industry of energy consumption have developed with the absence of pollution prevention measures. Therefore, these areas have problems of land, water, and air pollution, of which air pollution is the most apparent. In Figure 7, air pollution is made up of particles (PM2.5 and PM10) and harmful gases (O3, SO2, NO2, and CO). Among 338 Chinese cities investigated in 2018, only 25.7% of the cities had good air quality, and 20.7% had air pollution at different levels (see Figure 8).

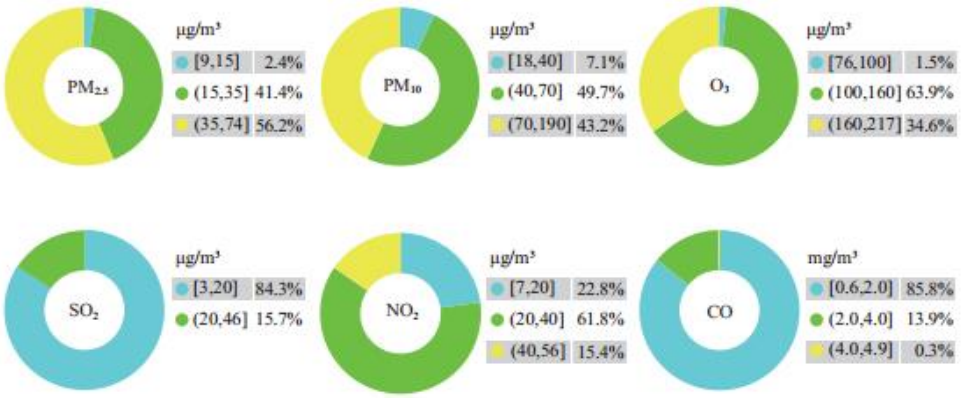

Figure 7 Species of air pollutant in China

Source: China's Ministry of Ecology and Environment

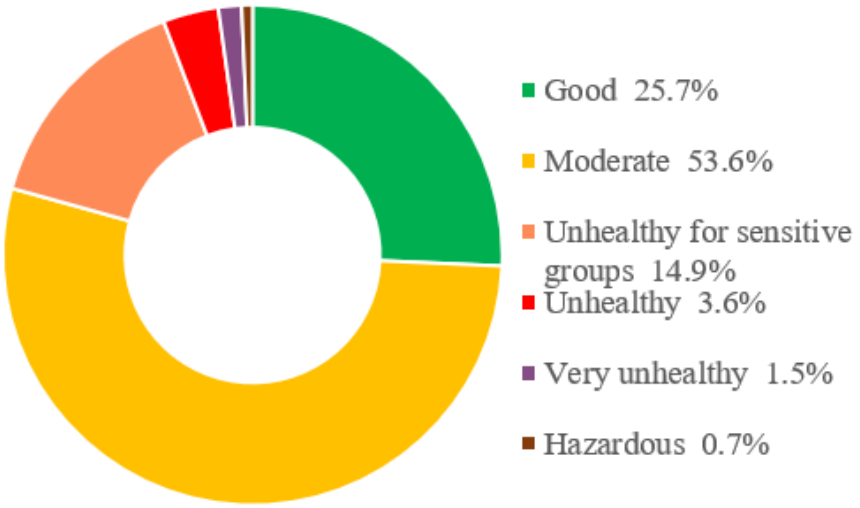

Figure 8 Air quality of 338 Chinese cities in 2018

Source: China's Ministry of Ecology and Environment

In the meantime, for the coastal areas, to meet the enormous needs of plastics, paper, and metal in low-end manufacturing, China has become an essential destination of global industrial solid waste, receiving 4.5 million tons in 1995 to 45 million tons in 2016 (Xinhua, 2018). Without the awareness and capacity for refuse disposal, this refuse, mainly chemical and electronic, has heavily polluted the land and water of China's host areas (*Ibid.*).

Besides environmental problems, this development trajectory (based on exports and investment) is also leading to growing asymmetries among the Chinese regions. As with the different effects of the two methods, southeast areas that use exports are more productive than the inland areas

that use investments. In Figure 9, the east area has a GDP share (53.35%) over the total share of the other three areas. In this sense, China's development has been in a stage of severe disequilibrium.

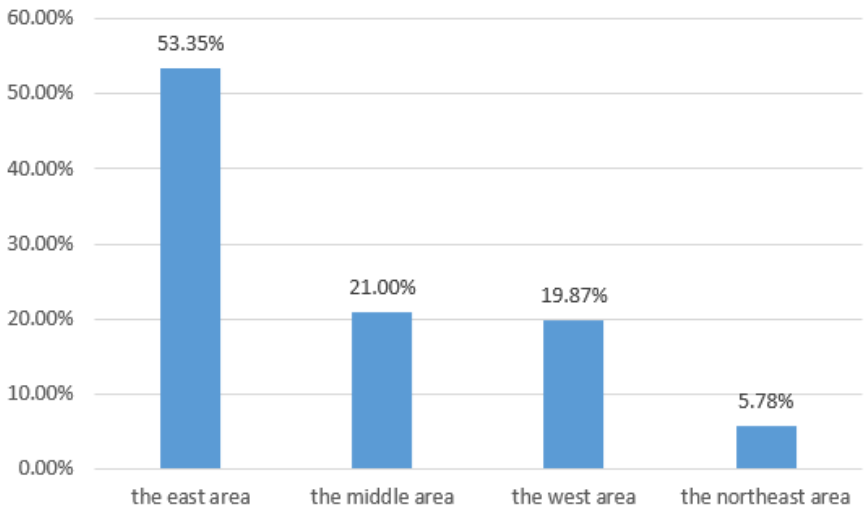

Figure 9 Share of the GDP of each area in national GDP in the first three quarters of 2018

Source: Translated by the author with the figure retrieved from http://www.cre.org.cn/list2/qyjj/14750.html

China's comparative advantage is attributed mainly to its large cheap labor force. However, China has been losing this advantage due to its reduced natural growth rate and its shift to an aging society. In Figure 10, we can see that China's natural growth rate has kept decreasing in the last three decades. Even though the two-child policy was substituted for the one-child policy in 2015 and gave an impulse to a natural growth rate, after 2016, the rate continued falling off.

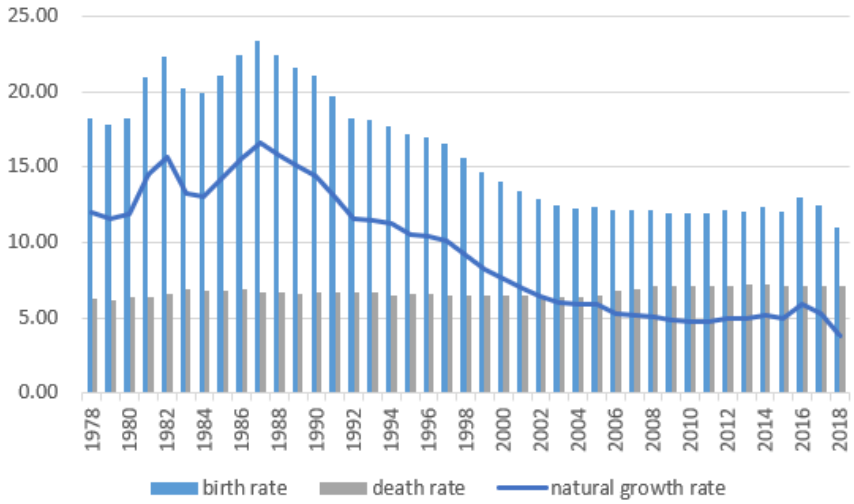

Figure 10 China's demographic situation in 1978 – 2018 (‰)

Source: Made by the author with the data collected from the NBSC site

Moreover, in Figure 11, we see that the percentage of the young population (in the 0 – 14 age group) is shrinking. According to the data of the World Health Organization (WHO) (2015), China's population aged above 60 will reach 0.402 billion, which will be 28% of the total population in 2040. It means that China will become an aging society before its full modernization in 2049.

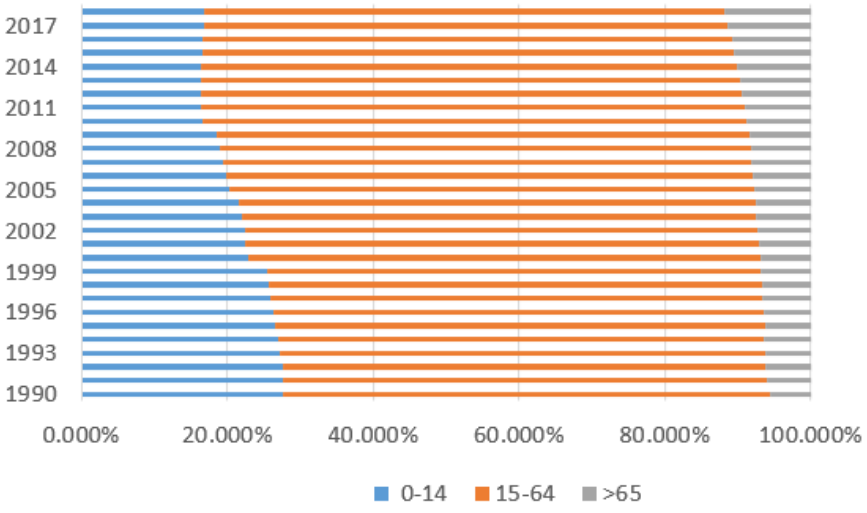

Figure 11 Proportion of China's different age groups in 1990 – 2018

Source: Made by the author with the data collected from the NBSC site

Therefore, from these perspectives, it is difficult for China to fulfill sustainable development supported by three pillars, namely, "economic vitality, environmental sustainability, and social progress" (Santana et al., 2015, p. 429). In this sense, China has a high risk of falling into the MIT.

2.2.PRE-EXISTING CONDITIONS FOR ACCOMPLISHING MIC2025

Confronted with the risk of MIT, China will attempt to carry out MIC2025 to achieve sustainable development. In this sense, it is meaningful to explore China's pre-existing conditions for performing the plan from the perspective of China's S&T policies, its technological base, and its foreign investment.

2.2.1. CHINA'S S&T POLICIES

China's S&T policies have evolved in four stages (Xue et al., 2018). Each stage has its priorities, features, targets, and projects (see Table 2).

Table 2 Four stages of China's S&T policies' evolution

Periods	Priorities	Characteristic features	Targets	Projects
1978 - 1998	high-tech industries	affirmation of S&T's position	revitalizing China's economy by science and education	*the Spark Plan*; *the Torch Plan.*
1998 - 2006	innovation of knowledge	formation of a national innovation system	building up national innovation bases; a national system of R&D; a modern system of science academy.	institutes on studying nanoscience, genome, photoelectricity, and planet environment; projects on cooperation between internal universities and foreign academies.
2006 - 2012	independent innovation	focus on major special projects; emphasis on basic research and talent cultivation	till 2020, the proportion of R&D will reach 2.5% of GDP; the proportion of commercialization of technological progress will reach 60%; the proportion of dependence of foreign technologies will decrease to 30%; the number of patents and papers of Chinese will both reach the world's top 5.	projects of electronics, chip, software, and communication; plans on attracting talents, for instance, *the Yangtze River Scholar Plan*, *the Hundred Talents Program*, and *the Thousand Talents Program*.
2012 - 2017	innovation-driven development	strategy for China to become a technological innovation power in 2050	China's position in overall innovation capacity reaches the world's top 15	projects in the MIC2025

Source: Compiled by the author with the data collected from Xue et al. (2018).

The first stage laid an essential foundation for China's S&T development. In this stage, the government gradually confirmed S&T's strategic position at various conferences[9]. Then, the government started to introduce industrial policies to promote S&T in different areas (Li, 2018).

[9] First, in the National Science Conference in 1978, the government abandoned the inferior position of S&T

The second stage mainly aims to establish a national innovation system under the oversight of the Chinese Academy of Social Sciences (the Academy). With the academy's proposals, the government started to build up the national innovation bases, a new national R&D system, and a modern system of science academies. Moreover, under the leadership of the Academy, China set up institutes for industrial purposes and tried new forms of cooperation between the internal and the foreign academies (Mu, 2018).

With the technological base founded previously, China started to make long-term programs for independent innovation at the third stage. CSC made the programs in 2006 in the name of *National Medium- and Long-term S&T Development Programs (2006-2020)* (the Programs). The Programs are designed to enhance China's capacity for independent innovation. Under the Programs, China has listed major special projects and talent cultivation plans (Cao, Li & Sun, 2018).

The fourth stage is still in the period of the Programs. However, this stage concentrates on innovation-driven development strategy with which China attempts to become a technological innovation power in 2050 (Chen, 2018).

2.2.2. CHINA'S TECHNOLOGICAL BASE

China's technological base has been constructed by two channels. One is the indigenous innovation motivated by S&T policies; the other is technological spillovers generated by FDI.

The indigenous innovations are proven by the growing R&D investment and development in human resource development and IP protection.

China has increased its R&D investment along with rapid economic growth. In 2016, the R&D investment reached 1567.7 billion yuan, with a proportion of 2.11% in GDP. In the total R&D investment, the basic research had a proportion of 5.20% in 2016 (Fang & Gong, 2018).

The growing investment in basic research leads to a yearly growing production of papers. In 2016, the number of China's papers in the Web of Science rose to the world top 2, close to the U.S. Also, for the number of papers being cited, China ranked the second yet having a gap with

formed in the Cultural Revolution and confirmed it as a force of production. Second, in the 12th National Congress of the Communist Party of China (CPC) in 1982, the S&T was regarded as an essential part of national economic development. Third, in the 13th National Congress of CPC in 1987, science and education were given priority in driving economic development. Lastly, in the National Technological Congress in 1995, the S&T was confirmed with the strategic position.

the U.S. in total number. Besides, China's patent number has increased, ranking fourth in 2015 (*Ibid*.).

Regarding specific industries, China has made progress in several industries of high-technology and obtained core technologies in space exploration, high-speed railway (HSR), and clean energy (wind and solar energy). Besides, China has also developed an internet industry through a secondary innovation. Its success is demonstrated by the performance of China's three tech giants, *Baidu, Alibaba, and Tencent* (BAT)[10].

The affirmation of S&T has helped revitalize China's universities. The government launched various projects to improve the R&D capacity of universities by "211 projects" in 1995 and "985 projects" in 1998. In order to hasten the commercialization of the R&D capacity of the universities, the government made a specific model. It combined the government, industries, universities, research centers, and markets (Liang & Li, 2018). Under this model, China has made a breakthrough in high-tech industries, represented by HSR (*Ibid*.).

FDI is the other important channel that has helped China build up its technological base. In the international context, FDI can effectively make technology transfer by MNCs (Ray, 1977). As the MNCs usually have relatively superior FSA (production technique, know-how, or management strategy) (Caves, 1996, *cit*., Girma, Gorg & Pisu, 2008), the recipient country can obtain positive spillovers according to its absorptive capacity (Girma, Gorg & Pisu, 2008); also, it can be included automatically in the GVC (Frobel, 1981, *cit.*, Haggard & Cheng, 1992).

To attract FDI and build up the absorptive capacity, the Chinese government has made various proceedings to build up its attractiveness and absorptive capacity, the most obvious of which is the establishment of various economic zones.

Specifically, from 1979 to 1990, China had opened up its markets in a gradient form, from Special Economic Zones (SEZs) to open coastal economic cities, then to open economic regions, and lastly to open inner cities (MOFCOM site, n.d.), namely:

- At the end of 1979, Guangdong and Fujian provinces obtained more decision-making power and preferential policies.

[10] *Baidu* has learned from *Google* and adapted the searching engine in China's market;
Alibaba has learned from *Amazon* and *eBay* and set up China's e-commerce network;
Tencent has learned from *Facebook* and *Twitter* and concentrated on social communication.

- In 1980, the four SEZs of Shenzhen, Zhuhai, Shantou, and Xiamen were set up in Guangdong as well as Fujian.
- In 1988, the fifth SEZ of Hainan province was set up.
- In 1990, fourteen open coastal economic cities, five open coastal economic regions, and forty open economic zones of inner cities were established.

The government has equipped these zones with not only the regulation of joint corporations and taxation (see Table 3) but also modern financial institutions. For instance, China's first group of modern financial institutions was set up in Shenzhen, the first SEZ in China (see Table 4).

Table 3 Legislation on foreign investment in China

Year	Legislation
1979	*Law of the People's Republic of China on Chinese-Foreign Equity Joint Ventures*
1980	*Income Tax Law of the People's Republic of China for Enterprises with Foreign Investment*
1986	*Law of the People's Republic of China on Foreign-funded Enterprises*
1988	*Law of the People's Republic of China on Chinese-Foreign Contractual Joint Ventures*
1991	*Income Tax Law of the People's Republic of China for Enterprises with Foreign Investment and Foreign*
1995	*Holding Company Law of Foreign-Funded Enterprises of the People's Republic of China*
2007	*Enterprise Income Tax Law of the People's Republic of China*
2019	*Foreign Investment Law of the People's Republic of China*[11]

Source: Compiled by the author with the data collected from http://history.mofcom.gov.cn/?specialthree=lywzjybsrfzjd

[11] This law substitutes *the Law of the People's Republic of China on Foreign-funded Enterprises*, *Law of the People's Republic of China on Chinese-Foreign Contractual Joint Ventures*, and *Enterprise Income Tax Law of the People's Republic of China.* It will come into force on January 1, 2020.

Table 4 The first group of financial institutions founded in Shenzhen

Year	Financial institutions	Nature
1982	*Nanyang Commercial Bank*	foreign capital
1982	*Ming An Insurance Corporation*	foreign capital
1985	*Shenzhen Foreign Exchange Adjustment Center*	Chinese capital
1986	*China International Finance Co., Ltd*	joint capital
1987	*China Merchants Bank*	Chinese capital
1987	*Shenzhen Development Bank*	Chinese capital
1987	*Shenzhen Stock Company*	Chinese capital

Source: Compiled by the author with the data collected from http://www.cbrc.gov.cn/chinese/home/docView/3225D180C7A04FE193C2D4872594BA9E.html and www.financialnews.com.cn/gc/ch/201805/t20180521_138446.html

Due to its geographical and cultural proximity, China's opening markets first attracted investors from Hong Kong and Taiwan. Though the investment was mainly used in the service and real estate industries, advanced methods of production were brought in automatically (*Ibid.*).

Besides the element of proximity, the FDI trend is closely related to China's openness, the world economy, bilateral relations with other areas, and the trading policies of other areas, which can be seen in Figure 12.

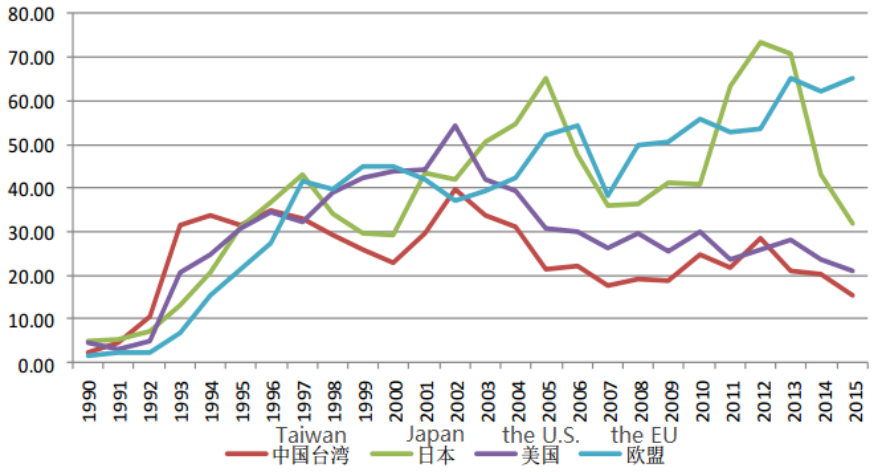

Figure 12 Origins of China's FDI from 1990 to 2015

Source: MOFCOM, 2016

In 1992, China decided to establish a socialist market economic system, which gave an incentive for the investment in China, mainly from Japan, the U.S., and European countries. Later, China's accession to the WTO in 2001 gave it another motive. Thus, in the Figure, the FDI shows a rapid increase after 1992 and 2001.

In 2001, the U.S. experienced an economic slowdown (UNCTAD, 2002), directly affecting its investment in China. Also, in 2004, the U.S. decided to repatriate the foreign affiliates of its companies by the American Jobs Creation Act (Organization for Economic Cooperation and Development-OECD, 2018), which made the U.S. outward investment shrink worldwide. After 2002, American FDI decreased rapidly in China.

Besides the world economy tendency, bilateral relations also affect FDI in China. The sharp decline of Japan's investment in China in 2005 was due to worsened relations by historical issues[12] (Huanqiu, 2005; Xie, 2013), and the one in 2010 was due to the incident on the controversial Diaoyu Islands[13] (Xie, 2013).

Lastly, a trading policy will also affect FDI. In 2006, the EU took a protectionist stance towards the Chinese market; thus, around this year, the EU's FDI remained low in China (Zhang, 2012).

As with more investment, the destination of FDI has diversified and flowed into the manufacturing and service industries (see Figure 13). Through processing, assembling parts of commodities and exporting, Chinese companies have been included in the GVC automatically.

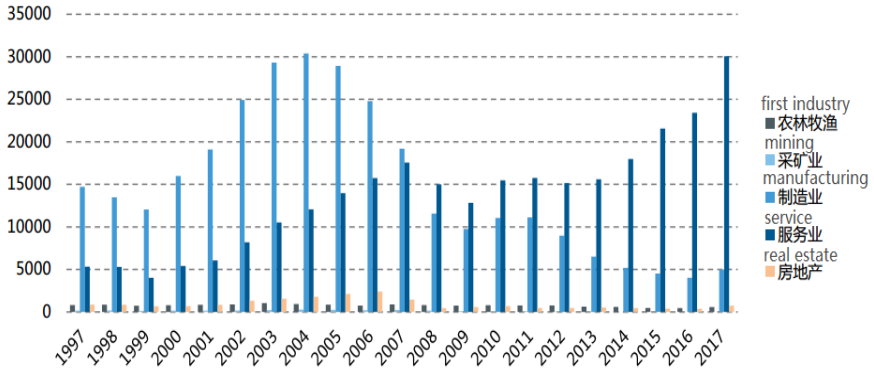

Figure 13 Distribution of foreign investment in China from 1997 to 2017

Source: MOFCOM, 2018

Besides, more MNCs have directly established headquarters and research centers in China, occupying an essential share in the country's total R&D activities. Specifically, in 2016, foreign-invested enterprises[14] had research personnel representing 22.8% of China's total,

[12] The historical issues indicate that in 2005, the 60th anniversary of the conclusion of WWII, the Japanese Government rejected its war crimes in its WWII Anniversary Resolution; and the then Prime Minister Koizumi visited the war criminal-related Yasukuni Shrine for the fifth time.

[13] The Diaoyu Islands are known as the Senkaku Islands in Japan. They are controversial islands for China and Japan. In 2010, a Chinese trawler collided with Japanese patrol boats near the Islands.

[14] The foreign-invested enterprises include those from the areas of Hong Kong, Macao, and Taiwan, China's

R&D expenditure represented 22.1%, and a number of patents represented 19.1% (China's Ministry of Commerce - MOFCOM, 2018). In this sense, Chinese companies can gain positive spillovers from those activities and improve their productivity.

In SEZs, the concentration of FDI has attracted millions of labors and talents from inner cities. The employment directly provided by foreign-invested companies reached 2.8 million in 1991 and 45 million in 2011 (*Ibid.*). The large quantity of labor and talent has increased the innovative capacity of the zones. Subsequently, in the process of innovation diffusion from MNCs and native companies, more companies have joined via further innovation. Chinese innovation clusters have thusly formed and gathered in these areas.

Regarding IP protection, China is a latecomer (Wang, 2018). Such is the case even though China has had its IP system developed for more than three decades (see Table 5). In 1980, China established the Patent Office of China (CPO) and acceded to the World Intellectual Property Organization (WIPO) (Cao, 2014). China's joining the Paris Convention for the Protection of Industrial Property in 1985 and its signing of the Trade-related Aspects of Intellectual Property Rights (TRIPs) agreement in 2001 have contributed mainly to the globalization of China's IP system (Wang, 2018). Besides this, since 2009, the government has made efforts to "more effectively" (Cao, 2014, p. 42) protect IP in making patent law, copyright law, and trademark law.

Ministry of Commerce, 2018.

Table 5 Milestones in the progress of China's IP system

Year	Milestones
1980	The CPO was established. China acceded to WIPO.
1982	The Trademark Law was enacted.
1984	The Patent Law was adopted.
1985	China joined the Paris Convention for the Protection of Industrial Property.
1989	China joined the Madrid Agreement on International Registration of Trademarks.
1990	The Copyright Law was promulgated.
1992	The Patent Law was amended to extend the scope of protection. China entered the Berne Convention for the Protection of Literary and Artistic Works, and the Universal Copyright Convention.
1993	The Trademark Law was revised.
1998	The State Intellectual Property Office was established, which superseded the CPO.
2000	The Patent Law was amended for the second time.
2001	The Copyright Law was amended; the Trademark Law was again revised and took effect; China was accepted into the WTO and signed TRIPS.

Source: Cao, 2014, p. 42.

However, despite the progress in China's IP system, we cannot ignore the existence of IP infringement in China (Cao, 2014; Yang & Zeng, 2010). On the one hand, it is due to China's inadequate law enforcement (Cao, 2014); on the other hand, China's industrial design has focused mainly on secondary innovation or re-innovation (*Ibid*.). This gave rise to China's *Shanzhai*, namely, "imitation or pirated brands" (*Ibid*., p. 44). Though re-innovations can save R&D costs and gain economic benefits quickly (Yang & Zeng, 2010), they eventually "hinder IP law enforcement and, in turn, motivate IP counterfeiters" (Cao, 2014, p. 44). In this sense, China's IP protection is still weak.

As an IP protection system is more critical than physical inputs (Powell & Snellman (2004), only through building up a good IP protection environment can China maintain the first-mover advantages from technological innovation. It can also guarantee innovators with new products winning in the market (Teece, 1992), which further forms technological competitiveness.

2.2.3. CHINA'S FOREIGN INVESTMENT AND REVERSE KNOWLEDGE SPILLOVERS

As with economic growth, China has had a growing need for more advanced technologies. However, it has been in the list of controlled transactions of core technologies by America under

the consideration of national security and industrial competitiveness[15]. Also, indigenous innovation needs massive investment, yet with a high risk of failure.

In this sense, China launched the "going global" strategy in 1998, encouraging companies of multiple systems of ownership to go out and explore the global market by outward foreign direct investment (OFDI).

China's OFDI has been motivated by its foreign exchange reserves (FERs). In 2006, China became the world's largest holder of FERs of U.S. $1066.3 billion (People Daily, 2013). Since then, China's OFDI has gained rapid growth (see Figure 14).

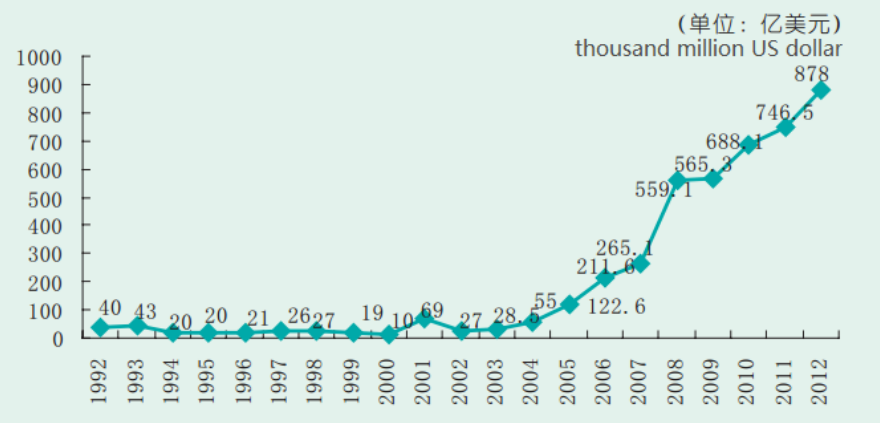

Figure 14 The flow of China's OFDI in 1992 – 2012

Source: MOFCOM, 2012

China's OFDI generally has two types: one is for resource-seeking and market-seeking in Asia, Africa, and Latin America; the other is for asset-seeking in Europe and North America.

Chinese SOEs and big private companies have constituted the OFDI's actors. They mainly flow into the industries of manufacturing, mining, finance, leasing, and commercial services, wholesale and retail, in Europe and North America. In addition to these areas, information technology in North America has also been a target (see Figure 15 and Figure 16).

[15] China has been in the list of Coordinating Committee on Multilateral Export Control and of its subsequent alternative, Wassennar Arrangement. To export high-tech to China, one has to obtain a license from the Bureau of Industry and Security of the American Department of Commerce.

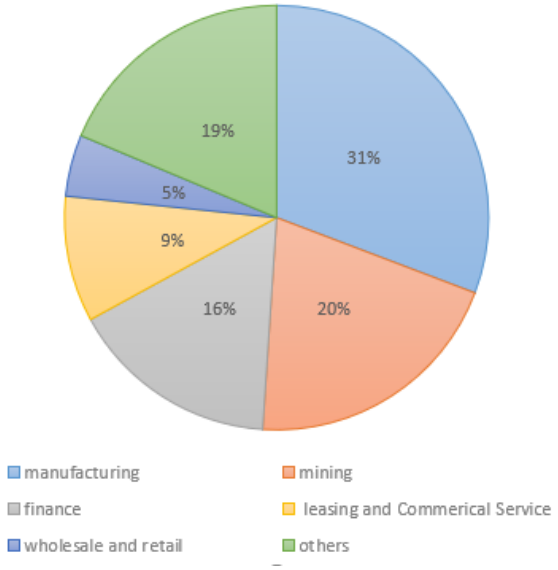

Figure 15 Distribution of China's OFDI in Europe in 2017

Source: Made by the author with the data collected from MOFCOM, 2018

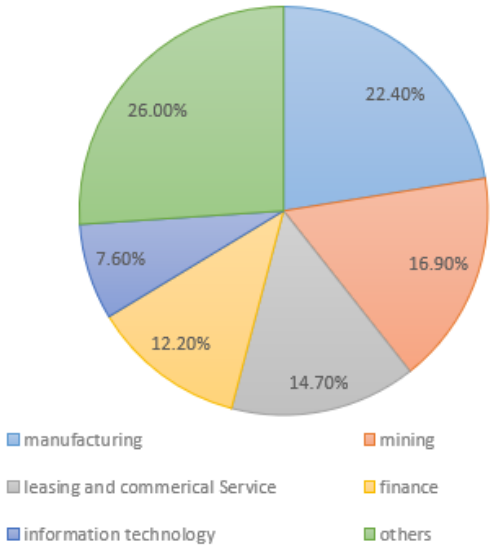

Figure 16 Distribution of China's OFDI in the North America in 2017

Source: Made by the author with the data collected from MOFCOM, 2018

The U.S. has been the primary destination for China's OFDI. Besides the aforementioned industries, Chinese companies also invest in scientific research and technical services (see Figure 17).

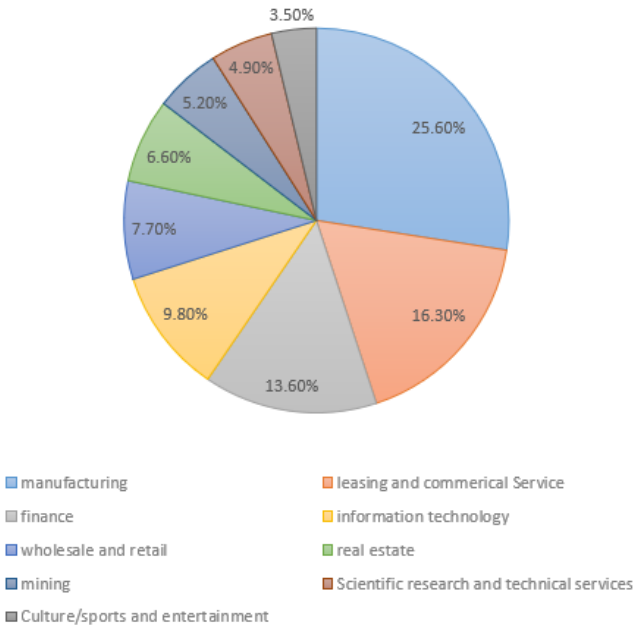

Figure 17 Distribution of China's OFDI in the U.S. in 2017

Source: Made by the author with the data collected from MOFCOM, 2018

The S&T investment is vital for China since Chinese companies can obtain technological spillovers with geographical proximity in the U.S. Thus, according to the MOFCOM (2018), at the end of 2017, the U.S. was the second-largest hosting place for China's overseas enterprises (with Hongkong being the largest).

After gaining advanced technologies and methods of production, those companies would be likely to transmit to their host companies in China. The transfer has given out reverse knowledge spillovers, bearing a decisive contribution to improving technologies and methods of production at home.

2.3.THE LIMITATIONS OF ACCOMPLISHING MIC2025

Though China has made a specific technological base, it has limitations in implementing the plan.

First of all, entrepreneurs, as the main protagonists in the process of innovation (McCraw, 2007), have been suppressed in China. In other words, China's economic system relies on the preponderance of public ownership, which causes preferential policies to go mainly to SOEs. They are dominant in critical economic sectors, like energy, oil refining, finance, real estate, and others (see Figure 18).

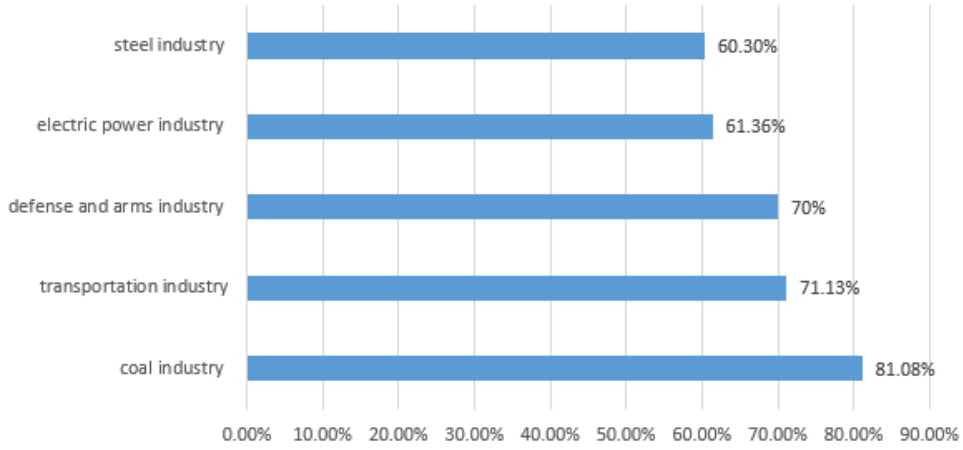

Figure 18 Share of public ownership in traditional industries in 2014

Source: Made by the author with the data collected from

http://finance.people.com.cn/n1/2017/0322/c1004-29161492.html

Though SOEs have occupied 20% of the total profits of the top 500 Chinese companies (China Daily, 2018), they have the problems of low efficiency and inflexibility and are the main actors in the surplus production of coal, steel, and electric power (see Figure 19). The surplus production has resulted in a high risk of deficit for the SOEs. At the end of 2014, over 35% of the SOEs were in a deficit state (People.cn, 2017).

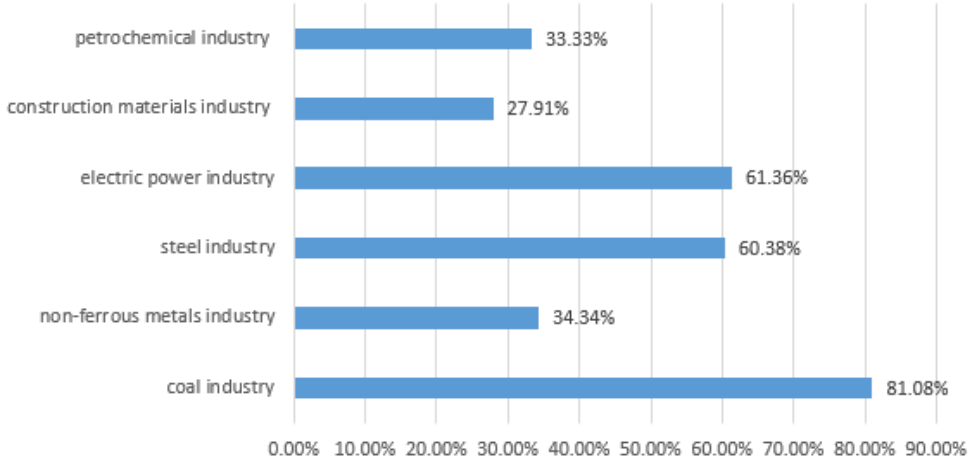

Figure 19 Share of public ownership in surplus productivity in 2014

Source: Made by the author with the data collected from

http://finance.people.com.cn/n1/2017/0322/c1004-29161492.html

On the contrary, private companies are much more efficient and flexible. Table 6 shows that they can reach a higher ratio of return on equity.

Table 6 Comparison of return on equity ratio between the SOEs and the private enterprises

Year	SOEs	Private ones
2013	11.20%	25.60%
2014	10.10%	22.50%
2015	7.30%	21.20%
2016	7.20%	20.60%
2017	9.40%	19.60%

Source: Compiled by the author with the data collected from http://chuangxin.chinadaily.com.cn/2018-11/21/content_37294505.htm

On the other hand, China still suffers from an inferior position in technological performance and is far away from standing at the technological frontier, which has long been dominated by Western countries.

Technological innovation is driven by endogenous and exogenous determinants, which are embodied in its performance in the areas of research, production, and markets (Hall, 1994; Rosenberg, 1985).

Regarding the research, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2018), in terms of the number of researchers per 1 million inhabitants, the U.S. had 4.3 thousand. The average level of G7 was 4.3 thousand. China only had 1.2 thousand researchers per 1 million, which is far below the average level of G7.

As for production, except those of high-technologies (space exploration, HSR), the core technologies in the MIC2025, ICT, industrial robots, and precision instruments are mainly dominated by western countries (see Table 7). Thereby, for a long time, China will still be dependent on foreign technologies.

Table 7 World top 10 companies in semiconductor, industrial robots, and precision instruments

No.	Semi-conductor companies	Origin	Industrial robotic companies	Origin	Instrument companies	Origin
1	*Intel*	the U.S.	*ABB*	Switzerland	*Thermo Fisher Scientific*	the U.S.
2	*Samsung*	the Republic of Korea	*Yaskawa*	Japan	*Shimadzu*	Japan
3	*Taiwan Semi-conductor*	Taiwan	*Kuka*	Germany	*Roche Diagnostics*	Switzerland
4	*Qualcomm*	the U.S.	*Fanuc*	Japan	*Agilent Technologies*	the U.S.
5	*Broadcom*	the U.S.	*Kawasaki*	Japan	*Danaher*	the U.S.
6	*SK Hynix*	the Republic of Korea	*Epson*	Japan	*Zeiss Group*	Germany
7	*Micron Technology*	the U.S.	*Stäubli*	Switzerland	*Bruker*	the U.S.
8	*Texas Instruments*	the U.S.	*Nachi Fujikoshi*	Japan	*Mettler-Toledo International*	the U.S.
9	*Toshiba*	Japan	*Comau*	Italy	*Waters Corp.*	the U.S.
10	*Nxp*	Netherlands	*Adept Technology*	the U.S.	*PerkinElmer*	the U.S.

Source: Compiled by the author with the data collected from https://www.investopedia.com/articles/markets/012216/worlds-top-10-semiconductor-companies-tsmintc.asp, http://www.chinadaily.com.cn/business/2015-11/19/content_22483256_10.htm, and https://cen.acs.org/business/instrumentation/Top-Instrument-Firms-2018/97/i9

For market performance, Chinese companies still have a large gap for internationalization. For instance, the BAT, as Chinese outstanding emerging companies, has encountered inadequacy in competing with western ones in the global market. In Figure 20, the BAT has a relatively small presence in the global market.

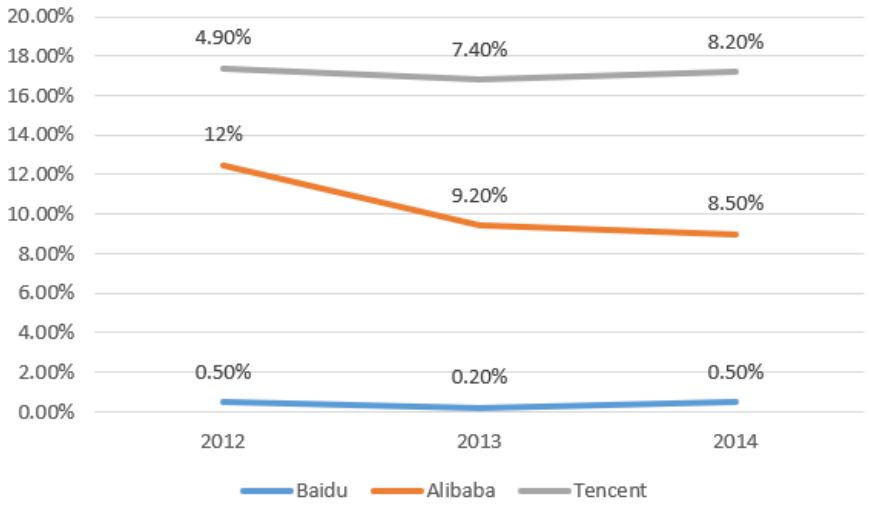

Figure 20 Share of overseas income of BAT in 2012-2014

Source: translated by the author with the data collected from https://www.ovdream.com/newsinfo/20151102104024f39fd0e38564affec.shtml

Therefore, as MIC2025 is highly innovation-driven, it can help China upgrade its industrial system owing to the existing technological base. However, the distribution may cause the anxieties of technological unemployment (Folgieri, 2016) in the process of automation. On the other hand, considering that the technological base is concentrated in coastal areas, the plan's performance may intensify the development gap between the coastal and inland areas.

Besides the problems the plan poses, China needs to resolve environmental and social barriers to sustainable development. In this sense, it is not easy for China to escape the MIT.

3. THE FUTURE OF CHINA'S RISE: TT OR CONTRIBUTING TO A MULTILATERAL WORLD ORDER?

3.1.CHINA'S RISE

In the past 40 years, China has increased its political power owing to its economic and technological progress. China has not only gained economic, military, and scientific capabilities but also exerted its influence worldwide through the distribution of those capacities.

China has a sizeable economic capacity as its national wealth measured by GDP ranks second worldwide. Economic capacity cannot be equated with economic power (Boulding, 1990; Viotti, 2001). Only through the distribution of capabilities can they exert influence then transform themselves into a world power (*Ibid.*). Foreign investment is the main instrument that China has employed to distribute its economic capacities to gain influence.

Since 2012, the reserve of Chinese foreign investment has entered the world top-three, close to Japan and the U.S. (MOFCOM, 2018). In 2015, the quantity of China's OFDI firstly surpassed that of FDI and maintained this trend in 2016 and 2017 (*Ibid.*).

Chinese OFDI, motivated by the "going global" strategy, has made Chinese companies gain access to resources, techniques, and brands that are absent in the internal market (MOFCOM site, n.d.). On the other hand, it has also contributed to the internationalization of Chinese products, services, techniques, and standards (*Ibid.*). Owing to these processes, Chinese companies obtain global competitiveness.

Though Chinese investment has distributed itself worldwide, its most substantial proportion goes to Asia, with a percentage of 69.5% in 2017 (*Ibid.*). Naturally, the OFDI will help China build close economic ties with other Asian countries.

Besides the distinct economic capacity, China also has an advanced military capacity. China has a significant defense expenditure guaranteed by economic growth, yet in a decreasing tendency (Huanqiu, 2019). In general expenditure, China was the second-largest military spender with a budget of U.S. $250 billion in 2018, compared to the U.S. $649 billion spending by the United States (see Figure 21).

Figure 21 Top 15 military spenders in 2018

Source: https://www.sipri.org/research/armament-and-disarmament/arms-transfers-and-military-spending/military-expenditure

With the expenditure and driving force of technological innovation, China has been modernizing its weaponry on land, water, air, and rocket force. It uses equipment of type 15

tank, type 052D destroyer, J-20 fighter jet, and Dongfeng-26 medium and intermediate-range ballistic missiles (Xinhua, 2019). The equipment listed in the White Paper of the Chinese Defense Ministry has a combat ability and is of China's independent innovation (Huanqiu, 2019).

As with a defensive position in national defense policy of never seeking hegemony, expansion, or sphere of influence, China distributes its military capacity by participating in multilateral treaties of anti-terrorism, arms control, disarmament, and nonproliferation. It also joins joint military exercises, U.N. peacekeeping operations, international humanitarian assistance events, and regional security dialogues and cooperation (Xinhua, 2019).

China's defensive policy and its participation in arms-control treaties cannot restrain its increasing military capacity. On the contrary, China's technological progress will continue to improve its weaponry, as military technologies have visible effects in "enhancing capabilities and cost-effectiveness (in performing missions); outperforming potential adversaries; symbolic roles; and preserving or improving stability" (Greenwood, 1990, p. 417).

The distribution of economic and military capacity constitutes China's hard power as they can exert influence through payments ("carrots") and threats ("sticks") (Boulding, 1990; Nye, Jr., 2004). However, hard power does have limitations in attaining its objectives, as coercion is not always successful (Nye, Jr., 2004). China's scientific capacity obtained in the past development has a different way of distribution, namely in science diplomacy.

On the one hand, China has conducted diplomacy for science, using diplomacy for "facilitating international science cooperation" (the Royal Society, 2010, p. 15). Presently, China has established technological relations with 156 countries and regions and signed 108 governmental scientific cooperation treaties (Li, Wang, T. T., Wang, Z. C., & Zhu, 2017).

On the other hand, China has used more scientific collaboration to improve international relations. As science itself is a source of soft power, scientific cooperation can "smoothen the political relations" (Leijten, 2017, p. 1). China has sent more than 140 diplomatic officers on S&T affairs in 47 countries, joined more than 200 international S&T organizations, and set up more than 500 global science and technology cooperation bases (Li et al., 2017).

3.2.CHINA'S RISE FOR THE WORLD ORDER: ANALYSIS OF CHINA'S PROPOSALS FOR THE ORDER

With its increasing power, China has launched various proposals both for Asia and the world in recent years. The country has done it in the name of building up a community of a shared future in Asia (Xinhua, 2019) and for humankind (Guo, 2018).

Under the scheme of the Asian community with a shared future, China has proposed its new concept of Asian security. Specifically, Chinese President Xi in the *Conference on Interaction and Confidence Building Measures in Asia* in 2014 proposed a new concept of regional security cooperation architecture, namely, "a common, comprehensive, cooperative and sustainable security strategy for Asia" (Xinhua, 2014, no page). The concept emphasizes the participation of every Asian country in security maintenance, that is, "security problems in Asia should be solved by Asians themselves through cooperation" (*Ibid.*). Moreover, it opposes military alliance and calls for equal security for every Asian country (Xinhua, 2014).

However, Asian security architecture belongs to the world security order constructed by America and its allies after the Cold War. In this area, America has maintained military pre-eminence and developed strategic allies with several Asian countries. Thus, it is not easy for China to substitute America to provide the public good in this area by promoting cooperation with a new security concept.

Regarding the community of a shared future for humankind, in economic terms, China's proposal is the Belt and Road Initiative (BRI), referring to the Silk Road Economic Belt and 21st Century Maritime Silk Road, which were subsequently proposed by President Xi in September and October in 2013 (Belt and Road Portal, n.d.).

On the Belt and Road Portal (n.d.), the Chinese government has positioned the BRI as an international cooperative platform and the global public good. The BRI routes attempt to connect China mainly with Central Asia and Europe.

Though the BRI routes spread widely, China primarily considers the neighboring countries and regions to cooperate with (People's Daily, 2019). Till present, 21 countries that surround China have signed the Memorandum of Understanding on BRI cooperation (*Ibid.*). The cooperation has largely increased trade flows between China with its surrounding countries. The value of import and export between China and 28 surrounding countries in 2018 has risen by 25% than that of 2012, surpassing the total value between China, America, and Europe (*Ibid.*).

In this sense, the BRI demonstrates the characteristics of regionalism and bilateralism. In other words, it focuses on Asia.

Besides the economic proposal, China has launched its political solution for the world, namely, building up a new type of international relations, based on mutual respect, fairness, justice, and mutually beneficial cooperation (Guo, 2018). From China's perspective, changing actual international relations in this direction is the only way to establish a community with a shared destiny, as the solution responds to the increasing demand to participate in the international politics of emerging powers (*Ibid*.). In this sense, the new relations will oppose a hegemonic hierarchy and elevate each country to equal participation. However, building up new relations will not lead to a new world order. Instead, it will contribute to the reform of the current world order under China's leadership (People.cn, 2018).

Though the order is not fixed and can be organized in different ways, the critical stakeholder will have a new bargain in order to renegotiate the authority of the order with the U.S. (Ikenberry, 2011). With respect to the Asian security architecture, China has various historical and territorial problems to resolve in the area, namely, the Taiwan issue, the South China Sea issue, and territorial disputes with Japan and India. Thus, Asia's security is crucial for China. On the other hand, since the end of WWII, America has kept its presence in Asia by developing various strategic allies. China's increasing aspiration for new Asian security possibly collides with America's interest in the area. In other words, China may have to renegotiate authority with the U.S. in Asia, most likely in the form of conflict or war.

For China's solution for the world, the BRI has developed a concentration on regionalism. It is doubtful that it can distribute worldwide and become a truly public good. Moreover, China's notion of a new type of international relations is likely to oppose America's hegemonic position. In this condition, China will also find itself negotiating with the U.S.

Therefore, in terms of China's rise and its proposals, China will probably have to renegotiate the authority of the world order with the U.S. and fall into the TT.

3.3. CHINA'S RISE IN THE WORLD ORDER: A COMPARATIVE STUDY OF JAPAN AND CHINA

After knowing China's rise and its proposals for the world, it is still necessary to analyze if China is a key stakeholder according to its rise in the current world order.

Similar to China, Japan is an important Asian country and was the second-largest economy in the 1970s owing to its "quiet diplomacy" (low-key diplomacy) (Potter & Sueo, 2003, p. 321) and concentration of inner economic development (Heginbotham & Samuels, 1998). Japan's reemergence increased the concern of the U.S. about the possibility of Japan becoming the number one economic power (Vogel, 1979, *cit.*, Azumi, 1980). In other words, Japan challenged American hegemony.

With the concern, the U.S. launched a trade conflict towards Japan and obtained "a tactical victory in the war with the 1985 Plaza Accord" (Hemmings, 2018). The result ultimately reduced Japan into a bubble economy and then into the Lost Decade. Even though Japan and the U.S. did not face power shifts and war due to their alliance, Japan still suffered huge and painful adjustments in their competition.

Currently, China has substituted Japan and become the world's second-largest economy, which has triggered America's concern about China's rise. Thus, it is meaningful to compare Japan and China from the aspect of their positions in the world order and their relations with the U.S. to analyze whether China challenges American hegemonic power. If China threatens American power, a power transition will be seen between the two countries; if this is not the case, the shift is not likely to happen.

3.3.1. POSITIONS IN THE WORLD ORDER

After WWII, the world was in a bipolar state. The hierarchy was marked by the ideological opposition between the communist and the capitalist camps, led by the Soviet Union and the U.S., respectively. As the two camps reached a balance of power, the world gained a 'Cold War' peace (Ikenberry, 2018).

Within the capitalist camp, America was the leader. Thus, it led the other allies to build up a world order organized around "economic openness, multilateral institutions, security cooperation, and democratic solidarity" (Ikenberry, 2018, p. 7).

Economically, before ending the war, the allied countries led by the U.S. had begun making rules regarding the regulation of their commercial and financial relations. In 1944, they achieved the Bretton Woods Agreement and established an international monetary system with specific rules, institutions, and procedures. These accords directly contributed to the

establishment of the International Bank for Reconstruction and Development and the International Monetary Fund (Ikenberry, 2018).

With the collapse of the Soviet Union, U.S.-led liberal multilateralism existed and spread outward (*Ibid.*). Thus, the world entered the World Order 1.0 (Haass, 2017), in which the U.S. was the principal provider of public goods (Nye, Jr., 2017). Those public goods included the management of rules and institutions, global security, the world economy, and liberal democracies (Ikenberry, 2018).

Although Japan was defeated in WWII, it has participated in the order's rule-making and defense, owing to its alliance with the U.S. It can be proved that the British and the French accepted Japan's entry into the General Agreement on Tariffs and Trade (GATT) in 1955 under U.S.'s pressure (Heginbotham & Samuels, 1998). Also, Japan successfully transformed itself into an advanced industrial economy at the end of the 1950s and joined the OECD in 1964 (Ashizawa, 2008). Through these steps, Japan has gradually been identified as "a sole member of the West in Asia" (*Ibid*., p.574). Thereby Japan, along with other western economies, became the defender of the order under the leadership of the U.S.

Different from Japan, China is one of the emerging economies that is struggling to change the situation of technological laggards (Song, 2016). China formally joined the world economic order in 2001 when it was admitted to the WTO. Though China is a later follower, it has founded regional institutions with other emerging economies, for instance, the Shanghai Cooperation Organization, and BRICS (Brazil, Russia, India, China, and South Africa). From this perspective, China diverges from its status quo as a follower of the order and is becoming a challenger instead (Nye, Jr., 2017).

3.3.2. RELATIONS WITH THE U.S.

The Japan-U.S. relationship is based on their military alliance, yet the alliance has asymmetric features (Sakaguchi, 2009).

With its defeat in WWII, Japan transformed its external policy from militarism into pacifism in the form of low-key diplomacy (Potter & Sueo, 2003) and made the Yoshida Doctrine with a focus on economic development (Heginbotham & Samuels, 1998).

In the field of defense, Japan is dependent on collective security through its alliance with the U.S., which was marked by signing a security treaty with the U.S. in 1951 (Ohira, 1964). However, the two countries' alliance is "an asymmetric relationship of things and people" (Sakaguchi, 2009, p. 29). In other words, Japan provided "things", namely, "the supply of bases and contributing to the cost of stationing troops" (*Ibid.*), while the U.S. provided "people," namely, "troops and the formulations of strategy" (*Ibid.*), for safeguarding the security of Japan and East Asia (Mathur, 2004). The asymmetric relationship has evolved with differences from the two parties about their defense arrangements (Stockwin, 1973).

Besides the security guarantee, Japan also benefits from the relationship with access to "U.S. markets for industrial products, technologies, and investment" (Heginbotham & Samuels, 1998, p. 176). Also, under America's support, Japan joined the GATT in 1955 and the OECD in 1964, which guaranteed the entrance of Japanese products in the European market (Heginbotham & Samuels, 1998).

Despite those advantageous conditions, Japan adhered to protectionism, making a series of nontariff barriers to limit foreign investment and imports (Lincoln, 1992, *cit.*, Heginbotham & Samuels, 1998). Under these circumstances, Japan achieved rapid economic growth and became the world's second-largest economy (measured by GDP) in 1968.

America, as Japan's largest trade partner (Stockwin, 1973), had a massive trade deficit with Japan. With military and economic advantages, America launched trading conflict towards Japan and finally obtained victory in a tactical way (Hemmings, 2018).

Different from Japan, China, since its foundation in 1949, has stuck to an independent foreign policy of non-alignment. Since China and the U.S. normalized their foreign relations in 1979, the bilateral relations have kept basically stable (Yan & Gong, 2018), yet with a complex of cooperative and competitive issues (Young, 2015).

In Deng Xiaoping's period, China kept a low-key profile in international politics and centered on economic development (Yan & Gong, 2018). On the other hand, the U.S. took the containment strategy (Fuchs, 2019), focusing on confrontation with the Soviet Union. Under this background, the China-U.S. relations developed at their course of normalization.

As with the end of the Cold War, the real superpower, America, shifted its containment doctrine to Clinton's democratic enlargement (Fuchs, 2019), that is, "expanding the community of free-

market democracies" (Foreign Policy's editors, 2009, no page). The doctrine led to the military intervention on China's issues, for instance, the Third Taiwan Strait Crisis (1995-1996), America's bombing of the Chinese Embassy in Belgrade in 1999, and the Hainan Island Incident in 2001. Those incidents deteriorated the relations between the two countries.

However, the occurrence of a terrorist attack in 2001 directly shifted America's foreign policy from enlargement to the global war on terrorism (Fuchs, 2019). America's strategic shift made the Chinese government define the first two decades of the twenty-first century as a period of strategic opportunity for its development (Jiang, 2006, *cit.*, Yan & Gong, 2018). Later, China joined the American-led nuclear nonproliferation activity and participated in the six-party talks on the North Korean nuclear issues (Tao, 2019). These actions contributed to form stable and positive relations between the two countries.

Under this background, the China-U.S. relations have developed through trading communication and cooperation on international issues. According to the data from MOFCOM (2007), in 2006, America became China's second-largest trading partner and the largest exporting market, while China surpassed Mexico and became America's second-largest trading partner and the fourth-largest exporting market. According to Figure 22, bilateral trading has increased faster than global trading from 2007 to 2014.

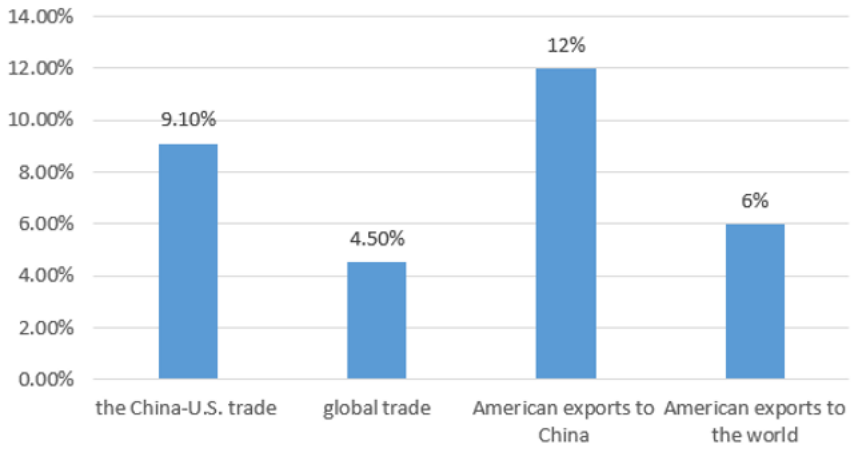

Figure 22 World trade average annual growth rate from 2007 to 2014

Source: translated by the author with the figure retrieved from www.ciis.org.cn/gyzz/2016-01/15/content_8536715.htm

Also, the two countries have cooperated on energy and the environment since the period of George W. Bush's administration. The cooperation led to the assignment of the U.S.-China Framework for the Ten-Year Cooperation on Energy and Environment in 2008 (Tao, 2019).

With rapid economic growth, China has gradually changed its "low-key" profile started in the Deng Xiaoping period (Yan & Gong, 2018) into a more proactive posture in global politics (Zhang, 2010). Namely, under the leadership of Xi Jinping in 2012, China put forward a "major country" diplomacy (great power diplomacy) and attempted to build up a community with a shared future for humankind (People.cn, 2017).

Though during the Obama administration, America attempted to rebalance its Asia strategy, namely, the "Pivot to Asia," it maintained cooperative relations with China on climate change, trade, military exchanges, and other issues (Young, 2015).

However, with the ascension of Donald Trump in 2017, America changed to the America First approach (Fuchs, 2019). Under this approach, America defined China as a revisionist country[16] and a strategic competitor[17]. On trading terms, the Trump administration launched a trade conflict with China that lasts until the present.

The shift in the American policy towards China has demonstrated that the stability in the China-US relationship is "tactical rather than strategic" (Yuan, 2009, p. 101). Further, the potential risks and problems will be likely to bring the relations into instability, namely, differences of social system and ideologies, the unsolved Taiwan issue, and "growing collisions between geopolitics and geo-economics" (*Ibid*.) between the status quo hegemon and the rising power (Yuan, 2009).

Therefore, in the world order, China's position does not pose threats to America's leading position. Also, the two countries have developed interconnected economic relations. From the development of their bilateral relations, they can find tactical ways to maintain stable relations. However, from China's perspective, it tends to reform the regional and global order for its own sake. China tends to change its *status quo* and becomes an order challenger. Besides, states are usually more cooperative in the sphere of the economy than security (Gill & Law, 1988). Thus,

[16] In the *National Security Strategy of the United States of America* issued by the White House on December 2017), the U.S. defined China as a revisionist power.
[17] In the *National Defense Strategy of the United States of America* issued in 2018, the U.S. addressed China as "Great Power Competitor".

it is not easy for the two countries to cooperate on security relations, which are more affected by "questions of history and national identity" (*Ibid.*, p. 35). In the Asia-Pacific area, China's interests overlap with the U.S. on multiple territorial issues (Taiwan and Diaoyu Island). Moreover, China proposes to enhance its presence in Asia with a more powerful identity. In this sense, China and the U.S. may fall into the TT concerning security issues in the region.

4. ANALYSIS WITH THE DATA FROM SEMI-STRUCTURED INTERVIEWS

JUSTIFICATION OF SEMI-STRUCTURED INTERVIEWS

The semi-structured interview is one of the two main types of interviews in qualitative research (Bryman, 2012). Qualitative interviewing will emphasize "the interviewee's point of view" (*Ibid.*, p. 470). As it is more flexible than quantitative interviewing (structured interview), it allows interviewer to "follow up interviewees' replies and (…) vary the order and even the wording of questions" to obtain "rich, detailed answers" (*Ibid.*).

In our research design, after obtaining a quantitative result, we need to collect and use qualitative data to analyze the results in a detailed way.

In the quantitative research, we concluded that MIC2025 has a dual instrumental function in China's development and rise to power. However, technological innovation will cause unemployment anxiety and intensify the development gap between Chinese coastal and inland regions. Moreover, China itself has many problems in terms of environmental protection, social justice, and IP protection, which make sustainable development and transformation more difficult to achieve. Regarding China's rise, China is not powerful enough to threaten America's leading position in the world order. However, China may protect its national security in the Asia-Pacific area and could face conflicts with the U.S. in the process.

However, quantitative research lacks information about the newest tendency of MIC2025 since it was launched in 2015 and original ideas about the prospect of China's rise. To resolve these insufficiencies, we have invited two interviewees, namely, one official from China's Embassy in Portugal and one reporter from China Daily. Both of the interviewees are familiar with China's technological issues and are interested in China's rise in world politics.

QUESTION DESIGN

Considering the flexible process of qualitative research, the question list for semi-structured interviews serves as an "interview guide" that allows the interviewees to have "a great deal of leeway in how to reply" (Bryman, 2012, p. 471). Also, in the process, the questions are not limited in the guide and can be added, "as the interviewer picks up on things said by interviewees" (*Ibid*.).

To obtain the original ideas and newest tendency about MIC2025, China's development, and China's rise, we have designed two groups of questions according to the interviewees' expertise.

- Question themes for the Chinese official,

- MIC2025 and China's development trajectory transference;
- MIC2025 and China's soft power;
- China's rise and relations with the U.S.;
- China's position in the world order.

- Question themes for the Chinese reporter,

- MIC2025 development, technological unemployment, and China's development transformation;
- China's risk of dropping in the MIT and the Chinese government's reactions;
- China's technological independence increased by MIC2025 and the possibilities of world technological split;
- Technological cold war and possibilities of TT between China and the U.S.;
- MIC2025 and China's soft power;
- China's IP protection situation.

INTERVIEW FORMS

The interview with the Chinese official (Wang L.) was in person and held in the embassy in Portugal. The interview was transcribed according to the notes made by the interviewer, as the interview was not allowed to be recorded.

The second interview with the reporter (requesting to be anonymous) was via telephone. With prior recording permission, the interview was transcribed according to the record.

DATA ANALYSIS

According to the interviews, both the interviewees are favorable for China's prospective development and the future of China's rise. Namely, China can shift from traditional development patterns to an innovative-driven pattern under the current policies and plans. Alternatively, owing to the interconnected economic relations among global economies, China and America can find ways to maintain cooperation and coexist peacefully not only in the Asia-Pacific area but also worldwide.

First of all, China's economic slowdown does not indicate that it will lead China into the MIT; instead, it represents an economic transition shifting "from high-speed growth to medium- and high-speed growth; from extensive growth to high-quality development" (interview, Wang, 2019). During the transition, China has been transferring its technological trajectory by using artificial intelligence (AI) and 5G and distributing policies of innovative entrepreneurship (*Ibid*.).

Further, in the process of distributing new technologies, China will temporarily encounter unemployment (interview, reporter, 2019). In reality, the distribution will help improve the workers' technical capacity (*Ibid*.). For instance, Guangdong and Zhejiang are two Chinese coastal provinces that are in the lead in distributing robotic technologies. Besides replacing some workers with robots, they have been equipping their workers with the know-how to operate the robots (*Ibid*.).

Moreover, new jobs will emerge (*Ibid*.). In the AI industry, data annotation requires a lot of labor to annotate the images and voices that will form the data for AI's processing (*Ibid*.).

The transfer of technological trajectory can effectively solve China's development disparity problem (*Ibid.*). According to the reporter from China Daily (2019), China has initiated an industrial transfer from coastal regions to interior areas. For instance, Wuhan (a central city) has become one of the receptors of the manufacturing system of computers, communication, and consumer electronics (3C) from the southeast areas; Hefei (another central city) has become an essential base for household appliance manufactures. Thus, the transfer inward can, to some extent, narrow the development gap between the coastal areas and interior ones (*Ibid.*).

China's industrial transfer does not exclude foreign enterprises (*Ibid*.). The company *Samsung* (a South Korean MNC) has participated in the process and set its semiconductor factory in Xi'an (a west city) (*Ibid*.).

Concerning independent innovation, another strategic aim of MIC2025, China will fasten its pace in the domestication of core technologies after the occurrence of *Huawei*'s sudden block caused by the use of its chip and operating system technologies of the U.S. (*Ibid*.).

As core technologies of commercial chips are dominated by the U.S. and the chip industries are highly globalized, China will inevitably continue to depend on American technologies for at least two or three decades (*Ibid*.).

In this condition, to gain technology competitiveness, China needs to stand at the technological frontier during the fourth industrial revolution. Therefore, China has been an essential catalyst in setting up a 5G standard. Also, nearly all Chinese ICT companies, both SOEs and private ones, have participated in the 3rd Generation Partnership Project (3GPP) to negotiate with foreign companies for uniform standards of 5G (*Ibid*.).

Besides 5G standards, China attempts to have independent technologies in the IoT era (*Ibid.*). Chinese tech companies like *Huawei* and *Baidu* have started to develop a platform with their technologies for IoT usage (*Ibid*.).

However, China still needs a "very long" time to build an independent technological ecosystem and will continue to depend on American technologies (*Ibid*.). In this sense, the technological cold war will hardly occur between China and the U.S.

Yet, China's consciousness of IP protection is growing stronger (*Ibid*.), which will help China gain technological competitiveness.

MIC2025 will not only help China form technical competitiveness but could also improve its attractiveness (*Ibid*.). For instance, the subsidy in the plan covers both domestic and foreign companies. The reporter gave an example of a new energy automobile (NEA) of which consumers can obtain subsidy by purchasing an NEA, whether in Chinese brands or foreign brands. Thus, MIC2025 can attract MNCs of new energy.

According to Wang (interview, 2019), the notion of TT was born in an isolated world. In the current world, economies are tightly interconnected by industrial and technological chains. Undoubtedly, countries need competition. The notion is with a Cold-War mind, resulting in a "lose-lose" game. With reference to President Xi, Wang (*Ibid.*) agrees that "the Pacific Ocean is big enough to accommodate China and the United States." That is to say, the two countries can find common interests in the Asia-Pacific area and coexist with each other peacefully.

In the world order, China tends to be a responsible big country. On the one hand, China will stick to its path and become "more and more open." (*Ibid*.). On the other hand, China will contribute its force to maintain globalization. The BRI is a public good that China provides for upgrading globalization (interview, Wang, 2019).

SYNTHESIS OF THE INTERVIEWS

Regarding China's prospective development, the interviewees maintain a realist position that China will upgrade the industrial system and obtain more economic power. This perspective accords with the notion of strategic industries in the political economy (Gill & Law, 1988). These industries are always crucial for a nation's security because they decrease dependence on other countries (*Ibid.*). The interviews demonstrate that China is in the process of domesticating core technologies and is being driven not only by economic benefits but also economic security.

On the contrary, the interviewees hold a liberal perspective that China can fulfill a peaceful rise owing to the economic interdependence in the world. In the liberal paradigm, international cooperation and integration can contribute to forming interdependence among economies (Labarre, 2007). The interdependence helps nations build up rational positivism (Maoz, 2009), and thus, it will "deter the likelihood of war" (Lee, 2018, p. 215). However, strategically interdependent states have increased security to deter aggression and then escape the conflicts (Kegley & Raymond, 1982, *cit*., Maoz, 2009). Meanwhile, economically interdependent states

are more likely to have conflicts with an increased frequency because the occasions for conflict multiply in interdependent economies (Lee, 2018). The Japan-U.S. and China-U.S. trade conflicts have proven this point. The conflicts are largely due to the U.S.'s "negative expectations on the future trade environment" (Lee, 2018, p. 215). In this sense, it is far from enough for China to use economic ties to escape conflicts with the U.S., let alone its conflict with the U.S. at this moment. Notwithstanding existing possibilities of resuming stable relations through economic cooperation, it still complicates the security relations. Security cooperation is more difficult than economic cooperation, and thus, security conflicts will more likely lead to the prisoners' dilemma (Gill & Law, 1988).

CONCLUSION

MIC2025 is China's strategic plan for both industrial upgrading and rising in the world order. The dual instrumental function of MIC2025 will not only affect China's prospective development but also influence the world order.

To respond to the research question of that, *is MIC2025 an instrument for China's development strategy to enhance its position in the world order*, we have accomplished the analysis through three parts, namely, the dual instrumental function of MIC2025, China's prospective development, and the future of China's rise. In the end, we have found that MIC2025 is highly driven by technological innovation and is especially closely related to core technologies of the fourth industrial revolution, ICT. Also, MIC2025 is crucial for the *China Dream* of full modernization by standing at the technological frontier. Then, concerning China's development, we have found that China's traditional development model has been exhausting its effectiveness; therefore, China needs to shift its trajectory, yet the shift will not be easy. China still stands far away from the technological frontier, though it has built up a specific technological infrastructure. Last, regarding China's rise, we have found that China has increased its hard and soft power, but it cannot threaten America's dominant position in the world order. In addition, China's proposals, whether for Asia or the world, are unlikely to become public good soon. Therefore, MIC2025 has limited effectiveness as an instrument for China's development and rising in the world order.

Concerning the first hypothesis that *MIC2025 can help China escape MIT and maintain sustainable development*, we can say that China's technological base can be helpful for its MIC2025 goals yet will have limited effects considering the distance from the technological frontier. Though China can maintain economic growth, it cannot be guaranteed to achieve sustainable development, which requires a combination of economic vitality, environmental sustainability, and social progress. Therefore, China needs to improve its environmental management capacity and enhance social justice efforts. In this sense, it is not clear that China can escape the MIT and maintain sustainable development.

Regarding the second hypothesis that *China, with the strength enhanced by the innovation plan, will escape the TT and contribute to the reinforcement of a multilateral world order*, we can say that China will not drop in the TT but doubtfully reinforce a multilateral world order.

Specifically, China is not powerful enough to challenge America's position. Development issues are still priority for the country. Thus, China will intentionally escape the trap. However, in Asia, China's interests overlap with America's. If China continues to aspire for more Lebensraum openly, the country may face a conflict with the U.S. In this condition, China's proposals for the world are more likely to enhance its position in Asia. Alternatively, China attempts to become an absolute Asia power by distributing its proposals mainly in this area. Thereby, China will reform the Asia order and likely have a conflict with the U.S. in Asia, not excluding other Asian powers (India and Japan).

Therefore, we can finally conclude that MIC2025 is crucial for China's catching up with the developed countries, as it is designed to build up China's strategic industries and then help China reduce dependence on foreign core technologies. However, China still needs foreign technologies in the coming decades. Thus, China will keep attracting FDI and maintain its cooperation with other economies.

MIC2025 also demonstrates China's shift in both technical paradigm and development trajectory. China can employ the plan to accomplish industrial upgrading and maintain economic growth but at a reduced rate. However, China cannot utilize the plan to achieve sustainable development without consideration of environmental sustainability, social justice, IP protection, and motivation of entrepreneurs.

On the other hand, in the process of catching up, China may prefer to escape the TT and focus on economic development. However, in Asia, with consideration of national security, China may not escape conflicts with the U.S. to defend its national interests. For China, reforming Asian order is more important than reforming the world order. From this perspective, China's proposals will likely build up its superior position in Asia.

The study has contributed insight into the analysis of the relations among industrial policy, development, and world order under the discipline of political economy in international relations. Specifically, the study has explored and built upon a theoretical structure of technological innovation, development, and power. Furthermore, to perform high-quality research, it involves mixed methods concerning the quantitative approach of first-hand materials and secondary analysis, and a qualitative approach of semi-structured interviews. The bibliography is distributed multilingually. Based on these conditions, the study has conducted relatively thorough research on China's industrial policy as well as its influence on China's

development and rise in the world order. Thereby, it can serve as a meaningful academic attempt to improve the acknowledgment of China in international politics.

However, as the study concerns multiple aspects, it has encountered inadequacy in some analyses due to the space limitation. In addition, semi-structured interviews only involve two Chinese interviewees, without opinions from other countries. In this sense, the analyses of the interviews become partial. Thus, these inadequacies can be left for other studies to improve upon.

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APPENDIX A

Semi-structured interview with Mr. Wang Lei (First Secretary and Vice-Director of Political Section (in technological issues) of the Embassy of the People's Republic of China in Portugal) – in the Embassy – 24 July 2019

1. Do you think that the manufacturing strategy motivated by technological innovation can promote the transfer of China's development path and enable China to achieve sustainable economic development under the new normal? Besides, how will this path of development be transferred?

I do not agree with the statement of the "economic downturn." I think that China's economy has been shifted from high-speed growth to medium- and high-speed growth; from extensive growth to high-quality development. It is inevitable that China's economic development will enter a new normal. Due to the decline of China's population and resources, the extensive growth model of the past has been unacceptable.

Now China's development is shifting towards the development model advocated by President Xi Jinping, that is, adhering to the development concept of innovation, coordination, green, openness, and sharing. Openness is to continue to adhere to reform and opening-up policy, and sharing is to advocate social fairness and justice.

In current China, it occurs not only the transfer of technological paths, like artificial intelligence and 5G but what is more the reform of the dual-innovation system of "mass entrepreneurship and innovation" (to encourage people to do business creatively and drive innovation). I have confidence in China's development.

2. How do you feel that China will use the manufacturing strategy driven by technological innovation to enhance its attractiveness to other countries and regions, thus enhancing China's soft power?

First of all, I want to say that the process from industrial upgrading to economic development is not that smooth and will encounter various problems to be resolved. A successful industrial upgrade will generate soft power. For example, China has obtained various achievements in large-scale technologies, Beidou Navigation Satellite System, high-speed rail, 5G, especially

the Chang'e 4's landing on the far side of the Moon, which is the first time in human history and caused a great interest of my Portuguese friends.

3. On July 12, 2019, China and Portugal set up a Star Lab on space technology advanced research. This can be a case of demonstrating China's soft power in a foreign country?

This lab is an implementation of President's last visit in Portugal, and also a fruit of nearly 16-years' preparations of our Embassy in Portugal. The laboratory aims to strengthen cooperation between the two countries in high technology, especially in satellite exploration, to help Portugal and also to serve as a driving force for bilateral cooperation. The laboratory is a joint initiative of small and medium satellite innovation institutes, universities, and research institutes.

The Chinese government will set up more and more joint laboratories. At the same time, we will promote the use of China's industrialization funds for companies in Portugal.

4. Do you agree with the notion of Thucydides Trap? If there is no war between China and the U.S., will there still occur a competition with the nature of Thucydides Trap, namely, zero-sum game? Can we say that the current Sino-American trade war is classified as such competition?

I do not agree with the saying of "Thucydides Trap." This statement was originated more than 2,000 years ago, in an isolated world. Today we are in a globalized world; various chains of technology and manufacturing have brought the nations together. I do not agree with this statement, but I think competition among countries is necessary.

China must adhere to a high-quality development approach, like "take your own path, no matter what others say." This is not only responsible for our own country and our people, but also responsible for all humankind. If China continues to adhere to its previous extensive development method, it will not conform to the interests of the entire human race.

Today, the United States adheres to a mentality of the Cold War and believes that there must be a war between the defending country and the rising one. This kind of zero-sum game is a lose-lose game. While, China adheres to a win-win foreign policy, just like President Xi Jinping said, "the Pacific Ocean is big enough to accommodate China and the United States."

5. Last month, the U.S. launched a New Prosper Africa Initiative and Access Africa Initiative,

tending to occupy more African markets and to promote its ICT. What do you think the Chinese government and companies in Africa should do?

Chinese companies have established a deep foundation in Africa. China and African countries have also developed a profound relationship. The Chinese government will not interfere with the development of Chinese companies in Africa. Chinese companies undergo legitimate competition in the African market. Those Chinese companies rooted in Africa all have carried out successful innovation of localization. These companies are not only represented by big companies like *Huawei* or *ZTE*, but what is more by relatively small companies, *Transsion* (a company from Shenzhen with a focus on the terminal of mobile communication). We welcome the competition.

6. How does China act as a big country? Also, how does China position itself in the current order?

Do well our internal things. The great achievements China has made since the reform and opening-up have proved that China has chosen the right road and adhered to the correct path.

In the past few decades, China has obtained its achievements, which cost European and American countries for nearly 200 years. China has achieved poverty eradication of 700 million people and made nearly 1.4 billion people have enough food and clothing.

China will adhere to the “four self-confidence” (confidence in the path, theory, system, and culture of socialism with Chinese characteristics). China will be more open and continue to embrace the world.

Although China is the world’s second-largest economy, China’s per capita GDP only occupies one-sixth of that of the U.S., so China is still a developing country.

China will assume the responsibility of being a big country and will not evade it. China's BRI is to carry out the “five-pronged approach” (promoting policy coordination, road connectivity, unimpeded trade, currency convertibility, and strengthened people-to-people ties). Till now, with more than 140 countries participating in the BRI, it can be proved that the initiative meets their interests.

The world order based on globalization cannot be split artificially.

China will be a responsible big country, to promote globalization, and to become more and more open, benefiting the world.

7. Can we say that the BRI is China's initiative supplementary to globalization, which gives benefit to the marginal countries?

BRI is a public product provided by China. I think it is an upgrade to globalization. China insists on the principle of "Seeking Common Ground While Shelving Differences." The facts will prove that countries can be benefited from participation.

8. Will the U.S. join the BRI in the future?

The Cold War mentality held by the U.S. tends to help it shift its domestic contradictions outward in order to obtain more votes. According to the chief interpreter of American ex-President Nixon and American diplomat, Chas W. Freeman, Jr., it is the U.S. itself that made China become its enemy.

APPENDIX B

Semi-structured interview with one reporter (responsible for following China's technological news) for technological issues from China Daily – telephone interview – 29 August 2019

1. "Made in China 2025" aims to help China's economic transformation through high technology. Will it lead to massive unemployment in the low-tech industry? Thereby it will cause an imbalance of China's development and increase the difficulty of China's transformation?

There will be some impact in the short term, but in the long run, it will not occur much unemployment. There are two trends. First of all, China's population is aging, the labor force is decreasing year by year, and the cost of employing people is getting higher and higher. For example, in the past few years, there has been a lack of labors in China's coastal areas. These enterprises cannot find people.

There are two trends now, and the distribution of high technology may lead to the loss of low-skilled personnel. China's labor-intensive industries are lacking. The two trends are parallel. I have asked many companies, and they said that within ten years, labor costs would double or triple, so the cost of employing people is very high.

Second, according to the experience of the technology companies I interviewed, Guangdong and Zhejiang are the two provinces with the most forceful implementation of robotics programs in China (both governments and enterprises are involved). They will replace some of the labor with industrial robots and collaborative robots. Besides, in some labor-intensive industries, they use mechanics through low-tech training workers for the mid-tech operation of robots. The cost is not that high. For example, the 3C (computer, communication, and consumer electronics) production line uses more and more robots. Workers are familiar with the assembly line business, and the company trains these workers to control the robots. This cost is not very high. The model can be distributed. The labor costs saved by the company in two or three years can offset the cost of using robots (purchasing costs and training labor costs).

The employment-population in these two years may be somewhat volatile, but in the long run, the impact is relatively small.

2. The long-term impact is relatively small, referring to not a lot of unemployment, right?

Yes, there will not be much unemployment. There will be more reemployment actually. The production of AI will bring new jobs. For example, in the AI industry, there is a labor-intensive work called “data annotation.” That is, the machine needs to recognize visual images and sounds. In the early stage, it takes many human resources to mark the images and sounds, and then form the basic data so that the machine can recognize the data. This kind of work is labor-intensive and has emerged in the last two years. That is to say, new technologies will also produce labor-intensive jobs.

Due to the high labor costs, the trend of lack of labor has reappeared. The two trends are parallel.

3. How do Guangdong and Zhejiang update their technology and update their robots?

The local governments give a small subsidy as an incentive policy. However, the manufacturing industry itself has significant demand. So, I feel that the promotion is relatively smooth. (For example, Zhejiang’s “machine substitution with robots” plan). For six consecutive years, China has become the world’s largest robot market. The quantity of robots deployed in China is the largest in the world. Although this rate has dropped this year, in the long run, the trend will continue.

4. The second question is that since the reform and opening-up, China’s rapid development has not only brought about development imbalances, but also environmental problems. Moreover, China’s birth rate has decreased in recent years, and the population has become aging. China has the risk of entering the middle-income trap. How do you think China should escape this risk?

In 2018, China’s per capita GDP reached 9,000 US dollars, and it has entered 10,000 US dollars. “Made in China 2025”, now is called the Manufacturing Power Plan. A big part of this plan is about industrial upgrading.

The middle-income trap will result in social disparity, stagnant industrial development, and uncoordinated regional development. However, the state has adopted many policies to solve these problems, including industrial upgrading. China Manufacturing 2025 is an important promoter.

The experts that I have interviewed have a view that because China is such big, its territorial area and its development between regions are naturally not coordinated. In this sense, multiple

industrial transfers can be completed within the country. For example, at the earliest time, the power plants were all located in the southeast coastal areas. However, in recent years, it has occurred industry transfer. The central city of Hefei has now become one of the largest home appliance manufacturing bases in China. Wuhan (another central city) is also known as an important 3C manufacturing base. These industries have been transferred from the southeast coast to the central city. It can not only help resolve the problem of development disparity and urbanization.

At the same time, after the transfer, the industrial upgrading of the southeast coast will also become fast. The Southeast Coast will have more energy and financial support to develop high technology, such as AI. Also, the state has made various polices to coordinate regional development, for instance, the Yangtze River Delta, Guangdong-Hong Kong-Macao Greater Bay Area. These are the policies adopted by the state to avoid falling into the trap.

5. In the second question, you mentioned that the state has specific policies to promote balanced development. Is China going to be an inward-looking economy, no longer relying on foreign consumer markets, and will protect its market like the U.S. now? Is it possible to fall into protectionism?

I feel that regional coordination (policy) is not carried out on a closed premise. China's regional coordination (process) also has many foreign companies involved, including industrial transfer. For example, Samsung has a large semiconductor factory in Xi'an (western city). This shows that foreign companies are also involved in this process. The domestic market is vast and can be transferred in this way. However, this does not mean that China is exclusive. It welcomes foreign companies. The Ministry of Industry and Information Technology also welcomes all foreign companies to invest in China and will build a fair environment for foreign companies.

Based on the current Sino-US trade environment, there may be measures to stimulate consumption within the country. Yesterday (August 28, 2019), the State Council issued a document to promote internal consumption. However, even in such an environment, the government still insists on internationalization and adheres to global cooperation. Especially when the relationship with the United States is tense, we have closer relations with countries such as Europe, Japan, and Australia. I feel that the country still attaches great importance to internationalization and global cooperation.

6. In the 2018 ZTE incident, the United States sanctioned ZTE and later reconciled. ZTE will continue to maintain cooperation with the United States? Alternatively, turn to independent research and development chips?

ZTE's own ability to develop chips is particularly limited. Semiconductor (involving one) a super-globalized industrial chain. *ZTE* cannot now wholly rely on itself; neither can *Huawei*. The IP used by *Huawei*'s HiSilicon chips is based on the ARM framework. ARM is a British chip design company. Many of ARM's technologies are developed in the United States. Now, the Chinese military has its R&D chips. However, in China's civilian market, all commercial chips cannot entirely shed their reliance on American technology. This is impossible. It is necessary that we need American technology now. After the *ZTE* incident, the domestic producer has increased their intention of domestication of chip technology. This is not something that Chinese companies take the initiative to choose. This is because the United States has taken the most closed approach, directly cutting off technology.

Last year's *ZTE* incident and the current *Huawei* incident, both have an impact on the entire Chinese technology industry. In addition to *Huawei*, many other mobile phone manufacturers, including AI companies, have anxiety over Sino-US trade issues. As many key technologies are developed by *Google*, including *Google*'s APPs, YouTube, Google maps to which *Huawei*'s latest mobile phones are not available overseas.

Therefore, domestication is not an active choice for Chinese companies. If open-source technology and American technology are available, providing them with a good technical framework, and then we (mobile phone manufacturers) can make the applications in a fast and profitable way. They are willing to do this (choose this model). However, this incident (*Huawei*) made them feel that it is impossible to continue this way (continue this model). At the very least, they must have a plan B.

It may take decades to achieve domestication. Whatever, the intention is getting stronger.

7. So now China is forced to choose such a path. My third problem is that after 20 or 30 years, China has a plan B and has its vital technology of ICT. Will the world occur a split of technical standards in the world?

This depends on the situation. Different industries have different ways of setting standards. Even in this context, the communication industry, according to my acknowledgment, is now a

global standard. The 5G standard is unified and is promoted by the global communications industry. There is an organization called 3GPP, which is dedicated to the development of this industry standard.

8. Which countries does this 3GPP consist of?

It is not an international organization. It is not made up of the state. It is made up of enterprises. Communications companies, including China, the United States, and Europe are all in this organization.

This standard (5G) is a globally unified standard, except for who has a greater discourse power in this standard. This year, Chinese companies have higher discourse power in the 5G standard, including *Huawei* and *Mobile*. They all led the process of standard-setting.

9. Without ZTE?

ZTE is also there. There are *Huawei*, *ZTE*, three major mobile operators, *VIVO*, *OPPO*, and *Xiaomi*; *Apple*, *Qualcomm* from the U.S.; *Ericsson* from Europe; *Vodafone* of UK; and the operators in Japan. It is these companies that have been discussing the 5G standards. So 5G is a standard for global unification. This is also what the Chinese government has been promoting, even in a stressful environment. That is, even the United States was already hostile to *Huawei*, China's primary goal was to ensure that Chinese companies' presence in the 3GPP organization was not much affected and then to promote globally unified standards.

The advantage of the unified standard is that the cost of laying a 5G network will be lower. So, this thing (standard) is driven by commercial profit. So, these companies are more willing to have a globally unified standard.

Therefore, the possibility of standard splitting slight. This is the case in the communications industry.

However, the underlying infrastructure may appear two sets later. In the IoT era, *Huawei*'s Hongmeng (operating system) will be the next operating system for the future. It means that Chinese mobile phone manufacturers will not rely entirely on Android. The Hongmeng operating system framework is different from Android. In the IoT era, all things can be connected to the network. In this condition, an operating system is necessary to control these

things. At that time, Chinese manufacturers may not be willing to use the American operating system.

Moreover, *Huawei* has started building its AI platform (ModelArts). *Google*'s (AI platform) name is TensorFlow. *Baidu* has developed PaddlePaddle (Baidu Deep Learning Platform), which is *Baidu*'s own original AI computing framework. *Huawei* has also developed the MindSpore computing framework. Therefore, Chinese manufacturers are slowly developing independently, one is to avoid similar incidents (*ZTE* and *Huawei* incidents) in the future, and the other is that Chinese manufacturers are becoming more mature and financially strong.

Besides, the operating system is the most profitable. Therefore, Chinese companies are also willing to operate independently. Guo Taiming (an entrepreneur from Taiwan) once said that there would likely be "one technology and two systems," one from China and the other form the U.S. This is possible.

However, Chinese companies need a very long time to develop a complete ecosystem of the operating system. It may take decades. This is not to say that it can happen in the short term. Therefore, some media have heatedly discussed the term "Tech Cold War."

10. Do you agree with the "Tech Cold War"?

I don't think that we have reached the point. Now, Chinese companies are dependent on American technology. China can't be independent suddenly. If the US government continues to sanctions Chinese companies, Chinese companies will accelerate its pace of independently developing even forcedly. In reality, this is a tough thing, a very difficult thing, with a high risk of failing. So, there is a possibility we are in the trend of going towards the so-called "Tech Cold War."

11. Will this so-called "Tech Cold War" lead to the outbreak of the hot war between China and the U.S.? The Thucydides Trap?

I don't think so. I don't think it will happen at this age. Because the trade interdependence between China and the United States is so high, it is impossible to go to war directly. I think the possibility of having a war is particularly low.

12. Is there a possibility of a regional conflict?

Regional conflicts may be in the Taiwan Strait, the South China Sea. However, the possibilities are not particularly high. There may be some demonstrations.

13. Will "Made in China 2025" enhance China's soft power?

This also depends on two aspects. The subsidies in China's manufacturing 2025 are not known to domestic companies but also overseas companies. For example, subsidies for new energy vehicles are subsidized to consumers. In other words, regardless of whether Chinese consumers buy new energy vehicles from China or *Tesla*, new energy vehicles from the U.S., they all enjoy subsidies. Therefore, Tesla sells in China and enjoys the subsidy of China. Therefore, the manufacturing plan will not only help China's industrial upgrading but also help China's consumption upgrading. In this sense, it will be attractive for foreign companies. According to the foreign companies I have interviewed, many companies expressed their willingness to join the manufacturing program, including SAP in Germany, *Ericsson*, and *Microsoft*. They all support the plan.

Most of the MIC2025 are imitated after the U.S. "Advanced Manufacturing Partnership project" in 2011.

14. Wasn't it the imitated after German Industry 4.0?

Germany's Industry 4.0 is also imitated and combined with the American plan. Also, in the U.S. plan, it is written clearly that the U.S. government will invest 500 million US dollars, with the nature of subsidies, to encourage enterprises to participate while China's subsidy policy is a support policy.

In MIC2025, there is an innovative manufacturing plan which replicates the U.S. Advanced Manufacturing Partnership Project. According to an export I have interviewed, the incentive policy and means of MIC2025 are similar to the U.S. plan. Therefore, the U.S. government often says that MIC2025 has spoiled up subsidies and disrupted the markets. It is learned from the American plan.

Then return to the issue of soft power. Foreign companies are willing to join the plan. Because the plan can bring them business opportunities, in this sense, it can improve China's soft power.

Besides, for the overseas Chinese companies, besides making money, they have done a lot of CSR (corporate social responsibility) in the local areas, for instance, constructing water and

electrical appliances in Africa. Also, *Huawei* has distributed its corporate culture in Europe. Except for the executing personnel, *Huawei* has hired many local people. Also, *VIVO, OPPO* sponsored Indian cricket matches and other sports events. These have specific effects on improving China's soft power.

15. What do you think of the phenomenon of “exchanging technology with the market” for foreign-invested companies in China? Besides, how do you think China’s current IP protection?

I don’t think there is a compulsory technology exchange for foreign companies. The exchanges occur under the contractual agreements that foreign companies themselves voluntarily reach with the Chinese government and enterprises. Companies like Microsoft that I interviewed have joint ventures in China, which is the result of voluntary optimism about the opportunities in the Chinese market. There is no mandatory. Also, the joint venture company operates according to the contract. Foreign companies have technical advantages, and the market is obtained through technology output, which represents the law of the market economy.

For IP protection, I think that in China it is progressing. Although there exist some problems, the awareness of protecting is growing stronger.